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THESIS

THE IMPACT OF FORCE REDUCTIONS
ON PROMOTIONS IN THE
NAVY MEDICAL SERVICE CORPS

by

Terri L. Butler

December, 1990

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91-13944

91 10 24 101

REPORT DOCUMENTATION PAGE

1a REPORT SECURITY CLASSIFICATION UNCLASSIFIED	1b RESTRICTIVE MARKINGS

2a SECURITY CLASSIFICATION AUTHORITY	3 DISTRIBUTION/AVAILABILITY OF REPORT
2b DECLASSIFICATION/DOWNGRADING SCHEDULE	Approved for public release; distribution is unlimited.

4 PERFORMING ORGANIZATION REPORT NUMBER(S)	5 MONITORING ORGANIZATION REPORT NUMBER(S)

6a NAME OF PERFORMING ORGANIZATION Naval Postgraduate School	6b OFFICE SYMBOL (If applicable) 36	7a NAME OF MONITORING ORGANIZATION Naval Postgraduate School

6c ADDRESS (City, State, and ZIP Code) Monterey, CA 93943-5000	7b ADDRESS (City, State, and ZIP Code) Monterey, CA 93943-5000

8a NAME OF FUNDING/SPONSORING ORGANIZATION	8b OFFICE SYMBOL (If applicable)	9 PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER

8c ADDRESS (City, State, and ZIP Code)	10 SOURCE OF FUNDING NUMBERS			
	Program Element No	Project No	Task No	Work Unit Accession Number

11 TITLE (Include Security Classification)

The Impact of Force Reductions on Promotions in the Navy Medical Service Corps

12 PERSONAL AUTHOR(S): Terri L. Butler

13a TYPE OF REPORT Master's Thesis	13b TIME COVERED From To	14 DATE OF REPORT (year, month, day) December, 1990	15 PAGE COUNT 139

16 SUPPLEMENTARY NOTATION

The views expressed in this thesis are those of the author and do not reflect the official policy or position of the Department of Defense or the U.S. Government.

17 COSATI CODES			18 SUBJECT TERMS (continue on reverse if necessary and identify by block number)
FIELD	GROUP	SUBGROUP	Medical Service Corps, Markov, Force Structure, Promotions, Personnel Forecasts, Manpower Models, Force Reductions

19 ABSTRACT (continue on reverse if necessary and identify by block number)

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20 DISTRIBUTION/AVAILABILITY OF ABSTRACT ☒ UNCLASSIFIED/UNLIMITED ☐ SAME AS REPORT ☐ DTIC USERS	21 ABSTRACT SECURITY CLASSIFICATION UNCLASSIFIED
22a NAME OF RESPONSIBLE INDIVIDUAL PAUL R. MILCH	22b TELEPHONE (Include Area code) (408) 646-2882	22c OFFICE SYMBOL 55 Mh

DD FORM 1473, 84 MAR 83 APR edition may be used until exhausted
All other editions are obsolete

The Impact of Force Reductions on Promotions
in the Navy Medical Service Corps

by

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B.S., Southern Illinois University, 1987

Submitted in partial fulfillment
of the requirements for the degree of

MASTER OF SCIENCE IN MANAGEMENT

from the

NAVAL POSTGRADUATE SCHOOL
December 1990

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ii

ABSTRACT

The objective of this thesis is to test an interactive PC based software model that allows manpower planners to study the impact of policy decisions on future inventories. This force structure model called "FORCE" and based on a Markov chain theory, allows manpower planners to use current inventory data and various estimates of continuation rates, promotion rates as well as planned accessions to forecast furture inventories. This thesis attempts to demonstrate the flexibility of this force structure model to monitor the effect of a reduction in force (RIF) on the Navy Medical Service Corps. Data from the Bureau of Medicine and Surgery Information System (BUMIS) for fiscal years 1985 through 1989 and projected promotion flow points from the Medical Service Corps five year plan were used in the forecast. The force reduction tested was a three percent decrease in force end strength each year for five consecutive years. The primary emphasis of the analysis is to determine the impact of this reduction on the promotion flow point to lieutenant commander and commander. The effects were examined for the aggregate Medical Service Corps as well as the Administrative subcommunity, assuming that they will bear the major portion of the force reduction.

TABLE OF CONTENTS

APPENDIX F

LIST OF TABLES

LIST OF FIGURES

ACKNOWLEDGEMENTS

I. INTRODUCTION

A. A BRIEF HISTORY OF THE MEDICAL SERVICE CORPS

The Navy Medical Service Corps was established by the Army-Navy Medical Service Corps Act of 1947. The original Corps was comprised of 255 officers (ensigns to lieutenant commander) serving as administrators, medical supply officers, optometrist, pharmacist and medical allied science specialists. [Ref. 1]

Today, the Medical Service Corps (MSC), numbers over 2,500 officers with approximately half serving as health care administrators (HCA) and the other half as health science specialist (HS). In 1989, physician's assistant became the twenty-first specialty added to the Medical Service Corps since 1947. Medical Service Corps officers serve in over 250 line and medical commands in both the Navy and the Marine Corps. Their varied assignments range from direct patient care at medical treatment facilities to support for operational and command activities.

In 1981, the Defense Officer Personnel Management Act (DOPMA) granted the Secretary of the Navy authority to convene a selection board and promote the first Medical Service Corps officer to the rank of rear admiral, to serve for a term of four years as the Director of the Medical Service Corps [Ref. 2]. On July 31, 1982, Lewis E. Angelo, RADM, MSC, USN became

1

the first Medical Service Corps officer to hold a flag rank
[Ref. 3].

B. BACKGROUND DISCUSSION

The distinct and diverse structure of the Medical Service
Corps presents many unique and challenging problems for career
planners and the community manager. Policy makers are faced
not only with the need to stabilize the mix of junior and
career officers and to provide career opportunity through
promotion, but they must also ensure that a sufficient number
of medical professionals are accessed or retained each year to
meet the subspecialty requirements.

In an effort to evaluate future staffing needs, forecast
losses, and manage personnel flows, manpower planners employ
a variety of analytical tools and models. One such model,
currently used by the Deputy Chief of Naval Operations (OP-
01), is the Structured Accession Planning System for Officers
(STRAP-O).

STRAP-O was developed by the Navy Personnel Research and
Development Center (NPRDC) in 1981, and the staff corps module
was implemented at OP-01 in March 1982. The main purpose of
STRAP-O was to determine the feasibility of sustaining
specific force structure levels by managing accessions,
promotions, lateral transfers, and various manpower overhead
(students, transients, patients, etc.) accounts. [Ref. 4]

STRAP-O has not been very successful at forecasting
information relative to the Medical Service Corps. One of the

major difficulties with STRAP-O is the level of aggregation of the data inputs. This particular model was designed to handle data segregated only to the level of a competitive category which does not account for the major differences between the HCA and HS officers in the Medical Service Corps. Inputs to STRAP-O are manpower requirements, which are specified by grade and community. This method cannot effectively account for the twenty-one different subspecialties associated with the Medical Service Corps.

Another weakness associated with this aggregate model is the assumption that officers are interchangeable between operational, support and managerial billets. For example, an engineer may be assigned to his operational tour on a ship and then follow that assignment with a tour on the Commander Naval Surface Force, Pacific (COMNAVSURVPAC) staff. His assignments are not restricted by his specialty as an engineer. While the HCA subcommunity within the Medical Service Corps does vary the officer assignments, the members of the HS subcommunity are highly specialized, with little or no flexibility to cross assign these officers outside their profession.

Another problem associated with STRAP-O is the treatment of the parameters such as continuation rates. The input for this parameter is an average over historical data. For large communities such as "surface warfare," with fairly constant rates, averaging usually provides a suitable approach. The smaller communities, such as the Medical Service Corps, tend

to have more fluctuation in the continuation rates, and the averages will not produce reliable forecasts.

Because of these shortcomings, the Medical Service Corps community manager could not depend on the forecasts of STRAP-O. As a result, MSC manager are still faced with the need to determine the optimal number of new accessions, and the expected or desired continuation rates necessary to maintain their current force structure, promotion opportunity, and promotion flow points.

C. THESIS OBJECTIVE

Recent changes in Eastern Europe and the Soviet Union have caused military strategist to reevaluate our military posture and reconsider the threats to our national security. An outcome of these changes is likely to be a smaller and more efficient military force. In his statement before the House Budget Committee, the Secretary of Defense, Dick Cheney, recommended a two percent per annum real decline in the defense budget for FY 1991 through FY 1995. He also recommended that active duty end strength be reduced to 2,038,800, which is 91,400 less than the FY 1989 level [Ref. 5].

The focus of this thesis is on the effects that policies such as a force reduction will have on promotion zones and flow points for the Medical Service Corps. A force reduction scenario will be tested on the aggregate data as well as the HCA data. Results of these tests will be discussed in detail.

4

The goal of this research is to provide the Medical Service Corps manpower planners with a tool to forecast inventories by grade and years of service. The analysis will employ the same force structure model used by Lieutenant Commander Karen Doyle, to test the impact of DOPMA constraints on the nurse corps [Ref. 6]. The model, entitled "FORCE", is an interactive computer software program that permits the user to select inventories, promotion rates, continuation rates, and accessions in order to forecast inventories and test the impact of proposed policies on future force structures.

In addition to the flexibility to select the variables and parameters, the data files used with the "FORCE" model can be developed for any level of segregation desired. In this analysis, data files were developed for the aggregate MSC community as well as the HCA and HS subcommunities.

D. SCOPE AND LIMITATIONS

A detailed discussion of the concepts of promotion opportunity, promotion flow points, and the impact of the Defense Officer Personnel Management Act (DOPMA) on end strengths is beyond the scope of this thesis. Additional information on these topics can be found in the Defense Officer Personnel Management Act, U.S. Title 10 and various Navy instructions [Ref. 2, 7, 8, 9].

The reliability of any model is dependent upon the accuracy of the data inputs. Appendix A and B describes some of the problems encountered with the Bureau of Medicine and

Surgery Information System (BUMIS) data set and explains the methods used to correct some of the errors, extract data pertinent to the model, and calculate missing year groups.

Additionally, the variables and parameters used in the model are subject to uncertainties in the environment and the unpredictability of human behavior. Large swings in future continuation rates may yield very different results than those obtained by using historical rates.

This analysis will only examine a situation involving a force reduction. However, the method demonstrated in this thesis can be used to test any number of alternative policy decisions. The emphasis is on presenting and explaining how to use a tool such as the "FORCE" model to examine effects on future inventories of proposed policies.

II. BACKGROUND AND ANALYTICAL FRAMEWORK

A. PROMOTION

One of the major revisions to the personnel process imposed by DOPMA was the single promotion system. The dual, temporary and permanent officer promotion system was replaced with a uniform promotion system that applied to all services. Promotion would now be controlled by a single set of statutory grade limits for all ranks above lieutenant commander.

DOPMA outlined a set of minimum promotion opportunities and promotion flow points as specified in Table 2-1.

TABLE 2.1 PROMOTION TIMING GUIDE WITH PROMOTION OPPORTUNITIES

Grade	Flow Point in YOS	Promotion Opportunity
To lieutenant (junior grade)....	2	100%
To lieutenant...................	4	95%
To lieutenant commander.........	10 +/-1	80%
To commander....................	16 +/-1	70%
To captain......................	22 +/-1	50%

Source: U.S. Senate, Committee on Armed Services, No 96-375 1979.

Annually, the Secretary of the Navy establishes the promotion zone in each grade based on available and projected vacancies in the next higher grade. The actual number of officers in the promotion zone is determined by taking the number of vacancies and dividing it by the promotion

7

opportunity. The junior officer in zone is then determined by counting down from the senior eligible officer who has not previously failed of selection to the grade being considered. For example, if there are 100 lieutenant commander vacancies projected for the next fiscal year, then since $100/.8 = 125$, one hundred twenty-five officers in the grade of lieutenant would be in the promotion zone.

The driving force behind the opportunity percentages in Table 2.1 was to implement control grade ceilings. DOPMA set statutory limits on the number of lieutenant commanders, commanders and captains that could be on active duty based on the overall size of the force. Congress felt controls were needed for two reasons: (1) the Department of Defense (DoD) was unable to justify the number of senior officers based on force structure requirements, and (2) the Department of Defense was suffering from "brass creep". The enlisted to officer ratio had changed from 8.6:1 in 1945 to only 6.5:1 in 1979. [Ref. 10]

By imposing grade limits, Congress hoped to eventually reduce the number of captains by 30 percent, commanders by 25 percent, and lieutenant commanders by 20 percent over ten years. In 1989, the Navy authorized officer end strength under DOPMA was 63,280, which meant there could be 11,811 lieutenant commanders, 7,039 commanders and 3,115 captains[1].

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[1]The number limit of regular Navy officers is set by public law. When the total number of officers serving on active duty is between two categories on Table 2.2, the corresponding authorized

8

The fiscal year 1991 end strength ceiling recommended by the Senate Armed Services Committee was 69,992 officers. [Ref. 11 p. 158] The DOPMA authorized grade limits are displayed in Table 2.2.

TABLE 2.2 OFFICERS AUTHORIZED IN THE CONTROLLED GRADES

Officer End Strength	Lieutenant Commander	Commander	Captain
45,000	9,124	5,776	2,501
48,000	9,565	5,984	2,602
51,000	10,006	6,190	2,702
54,000	10,447	6,398	2,803
57,000	10,888	6,606	2,904
60,000	11,329	6,813	3,005
63,000	11,770	7,020	3,106
66,000	12,211	7,227	3,206
70,000	12,799	7,504	3,341
90,000	15,739	8,885	4,013

Source: U.S. Code, Title 10 - Armed Forces, Chapter 32, p120

Congress and the Secretary of Defense determine the overall end strength for each branch of service. Once the Navy's limit is established, control grade authorizations within the guidelines specified by Table 2.2 can be identified. The Secretary of the Navy divides these authorizations among the competitive categories, and the

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strength for each of the grades is determined by mathematical interpolation between the respective numbers of the two strengths.

Medical Service Corps is given its ceiling under the Restructured Officer Program Authorizations (ROPA).

The ROPA numbers provide targets for the current year, and the actual inventories may not exceed the ROPA limits for the control grades. However, if the inventory of captain MSC officers is below the ROPA, the extra authorizations may be "carried-down" to the end strength authorizations for commanders. For example, the MSC five year plan submitted in August 1989 reflected a beginning inventory of 129 captains. The projected authorized end strength for 1990 was 149 captains. Under ROPA, authorizations were set at 215. As pictured in Table 2.3, this shortfall of captains provides a carry-down of 66 officers, which can be applied to the authorizations for commanders. Likewise, shortfalls in commander end strength provides carry-down to lieutenant commander, etc.

TABLE 2.3 FY-91 MSC FIVE YEAR PROMOTION PLAN (EXTRACT)

	FY90 CAPTAINS	FY90 COMMANDERS
BEGINNING INVENTORY	129	303
PROJECTED END STRENGTH	149	314
RESTRUCTURED OPA (ROPA)	215	324
CARRY-DOWN	0	**66**
TOTAL AUTHORIZATION	215	390
SHORTFALL	**-66**	-76

Source: FY-91 OFFICER GRADE PROMOTION PLAN FOR MEDICAL SERVICE CORPS

10

B. CONTINUATION AND SELECTIVE EARLY RETIREMENT

The Defense Officer Personnel Management Act provides the Secretary of the Navy (SECNAV) the authority to convene continuation boards and consider those officers who have twice failed of selection for continued active service. The Secretary of the Navy determines which of the competitive categories will have continuation boards subject to the needs of the Navy.

As specified in the records of the Senate hearing from the Committee on Armed Services:

> The selective continuation procedures are intended to be used sparingly and are primarily a means of reducing the numbers in grade when necessary, such as a reduction in force.

Similar comments were made for the selective early retirements:

> These selective early retirement provisions are intended to be used sparingly and are primarily a means of reducing the numbers of officers in these grades when necessary to accommodate such actions as a reduction in officer personnel strengths. These provisions are not intended to be used solely for the purpose of maintaining or improving promotion opportunity or promotion timing.

Historically, regular Navy MSC officers at the grade of lieutenant, who twice fail of selection are separated by the first day of the seventh month following the month the President approves the report of the selection board that considered the officer for the second time.

If the lieutenant is within two years of retirement eligibility by the seventh month following the selection board

11

which considered him for the second time, he is retained until he is qualified for retirement.

Lieutenant commanders who have twice failed of selection are routinely considered for continuation. Previous continuation boards were not provided quotas from The Secretary of the Navy, which allowed the board to grant 100% continuation of those officers it considered.

Selective early retirement is another tool available to the top Navy officials to reduce inventories in the grades commander through rear admiral. Under DOPMA, the Secretary of the Navy may convene selective early retirement boards during periods of officer strength reduction. To maintain the pyramidical structure of the number of officers in each grade, senior grades must be reduced commensurate with reductions in the lower grades.

C. CONSTRUCTIVE CREDIT

Many of the health care specialties require masters or doctorate level degrees. Constructive credit is awarded to these professionals in compensation for the advanced education attained prior to their appointment. Constructive credit is used to determine an officer's initial grade and seniority in that grade for promotion eligibility to the next higher grade. For example, the minimum qualifying degree for a Navy biochemist is a masters in biochemistry. This officer can be granted 24 months of constructive credit for this advanced degree. If he were to receive his appointment in 1989, his

12

year group would be established as 1987, because he receives two years of constructive credit.

In addition to the general guidelines provided in DOPMA, the Navy has established specific regulations for Medical Service Corps officers [Ref. 12]. Entry grade or service credit is awarded for prior active commissioned service. A combination of entry-grade and constructive credit is usually limited to a maximum of six years.

D. WORKING DEFINITIONS

1. Year Group.

An officer's year group (YRGRP) is determined when he/she enters active duty. For most officers, this will be the year of appointment, i.e. the current fiscal year. For those MSC officers who receive constructive or service credit, the year group can be computed by subtracting the number of years of credit from the fiscal year of the officer's appointment.

2. Years of Service.

In most military reports and studies, years of service is considered to be the number of years of active commission time served to date, and is computed from the active commission base date. This method of computation does not consider the constructive credit granted to many of the allied health professionals.

Because the focus of this research is on promotions, the year group is more essential for monitoring changes to the

13

promotion flow points than the officers creditable active service which is used for retirement eligibility considerations. For this reason, the years of service (YOS) in this model will be computed as the current fiscal year (FY) minus the officer's year group (YRGRP). **YOS = FY − YRGRP**.

3. **Inventories**.

Although fiscal year end strength is often adopted as the measure of inventories, the "FORCE" model inventories are measured from the beginning of a fiscal year. These beginning inventories, or stocks, can be used to compute both the promotion and continuation rates.

4. **Losses**.

A loss is defined as any officer that leaves during the fiscal year who was there at its beginning. A loss is always credited to the grade and YOS category which the officer possessed at the beginning of the fiscal year. For instance, if a lieutenant junior grade (LTJG), is promoted to lieutenant (LT), but is released from active duty that same year, the loss is counted against the LTJG inventory because that is where he/she was counted at the beginning of the fiscal year.

This model considers the personnel flows of ensigns to captains, with one to thirty-one years of service. Therefore, an officer promoted to Admiral or reaching his thirty-second year of service will be counted as a loss from the system.

14

Officers who transfer out of the Medical Service Corps and into another competitive category or another branch of service must also be counted as a loss. Transfers between subspecialties are also counted as losses (or gains), when modelling a subcommunity of the Medical Service Corps. This concept will be explained in more detail in Appendix A.

5. **Continuation Rates.**

The continuation rate is computed as the percent of the beginning inventory that is still on active duty at the end of the fiscal year.

6. **Accession.**

An accession is a new entrant into the system during a fiscal year. This may be a new appointee, an officer recalled from inactive status, or any lateral transfer into the Medical Service Corps. For consistency, the YOS for accession is recorded in the model from one to thirty-one just as for inventories. If we apply the formula: YOS = FY - YRGRP, accessions into 1985 with a YRGRP of 85 would have zero (0) years of service. The model records the YOS as one, because the officer's years of service fall within the interval of zero to one. In practice, we would speak of this officer as having one year of service. Thus for computing YOS for accessions, the formula is: **YOS = FY - YRGRP + 1.**

7. **Promotion Rates.**

The definition of the promotion rates used in the model is the proportion of officers selected for promotion

divided by the inventory of officers at the beginning of the fiscal year with the same years of service. For example, in 1988, beginning stocks revealed 122 lieutenants (LT), with nine years of service. Fifteen of these officers were selected for promotion by the fiscal 1989 promotion boards. Therefore, the promotion rate for LTs with nine years of service was .123 in fiscal year 1988. Stated another way, 12.3 percent of the LTs with nine years of service were selected for promotion to the next grade in that fiscal year.

8. **Personnel Flows.**

Entrance and exit from the system and movements within the system can be described as personnel flows. To understand the flow, we must first define the system. Our system is defined by a 6 x 31 matrix, which represents the grades ensign to captain and the years of service one through thirty-one. Each "cell" of this matrix can be referred to by its row and column address. We can label the cells as the ith row (YOS), and the jth column (grade). The number (c) in each cell of the matrix represent the number of persons with i number of year of service and with grade j and gives us the notation of c_{ij}.

A flow within the system, pictured in Figure 2.1, can then be described as movements from, e.g. cell(1,1) (1 YOS, ensign) to cell(2,1) (2 YOS, ensign). In a length of service model, everyone gets one year older during the period of one year, therefore, no one can stay in the same cell or the same

16
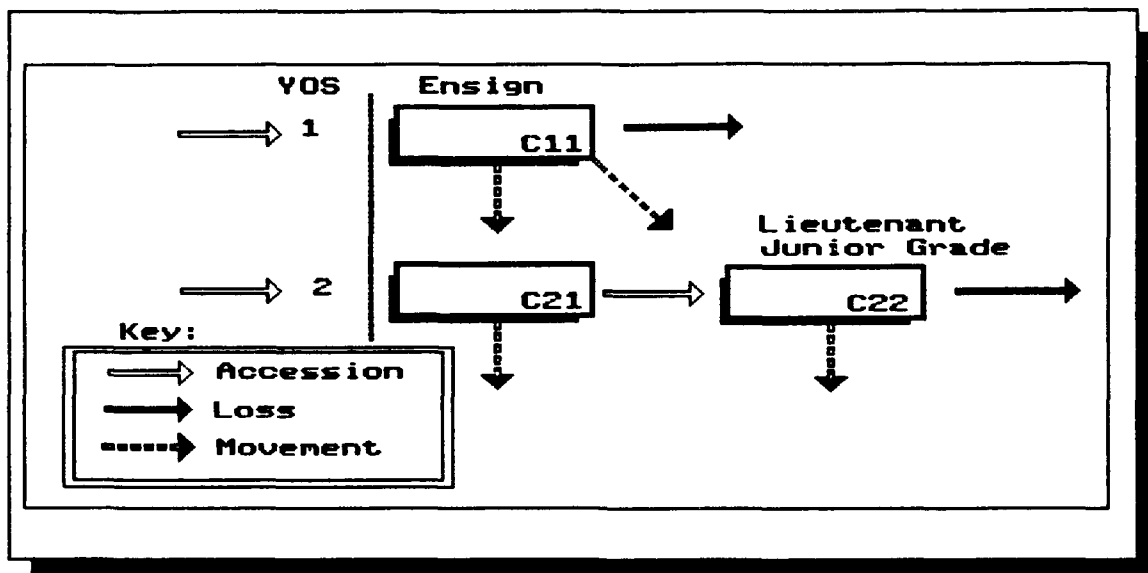
FIGURE 2.1 Personnel Flows

row. Movements must be to the next YOS in the same grade, the
next YOS but one grade higher, or out of the system. Flows
into the system are called *recruitments* or *accessions*, flows
out of the system are losses, attrition, or wastage.

9. **Parameters**.

The parameters used in this model are promotion rates,
continuation rates, and accessions. By controlling one or all
of these parameters, a manpower planner can attempt to reach
the force structure he desires. It is seldom desirable to
adjust all three of the parameters at the same time. Manpower
planners will usually fix two of the parameters and then
control the system flows with the remaining parameter. [Ref.
13 p.209]

Of the three parameters, accessions into the system is
often the easiest to control. In our model, promotion rates

17

vary from year to year, however, they are conceptually fixed by the promotion opportunity and timing regulations outlined in DOPMA. Continuation rates are subject to many environmental influences and the uncertainty of behavior.

10. **Steady State or Equilibrium**.

Steady state, stationary state, or equilibrium is a hypothetical condition in which the parameters remain constant from year to year and the losses, gains and inventories don't change. Under conditions of growth, steady state would refer to the proportion of stocks in each cell remaining constant over time.

11. **Markov Chain Models**.

Markovian models can be useful as a manpower tool to forecast inventories and predict vari us personnel flows. This analysis will employ a Markovian length-of-service model. The use of this model requires a basic understanding of some of the underlying assumptions inherent in Markov theory.

Markov models assume that the probabilities of moving from one cell to the next in any period, are independent of how the person got to that cell. This is often expressed by stating that the system is "memoryless". [Ref. 13 p. 87]. In other words, the model assumes all officers at the same grade and years of service are equal in terms of the probability for promotion or attrition in the next period.

18

Another underlying assumption of Markov models is the existence of mutually exclusive and exhaustive classes. A person is in one, and only one, category at any one time.

Markov models also assume consistency or stability in the parameters, and that patterns observed in the past will continue into the future [Ref. 13 p. 86]. This assumption is critical when forecasting future inventories as many economic or political factors may change future parameters. The results .f this analysis are dependent upon stability in future parameters. This will be discussed in further detail in Chapter 4, Section A and Chapter 5, Section A.

III. THE FORCE STRUCTURE MODEL AND DATA

A. DESCRIPTION OF THE MODEL CALLED "FORCE"

1. Selecting the Data.

Fifteen data files are provided with the model. Five of the files contain data for the aggregate Medical Service Corps for fiscal years 1985 through 1989. These files are labeled MSCFY85 to MSCFY89. Another five files contain data specifically on the Health Care Administration specialties. These files are labeled HCA85 to HCA89. The remaining five files contain data on the Health Science specialties and are labeled HTHSC85 through HTHSC89.

Each of the data files contains the following seven components:

- Explanation of file contents
- Inventory by years of service and grade (31 x 6 matrix)
- Accessions during the fiscal year by years of service and grade (31 x 6 matrix)
- Losses during the fiscal year by years of service and grade (31 x 6 matrix)
- Selectees during the fiscal year by years of service and grade (31 x 6 matrix)
- Continuation rates by years of service and grade (31 x 6 matrix)
- Promotion rates by years of service and grade (31 x 6 matrix)

The model is designed to allow the user to select data in several different ways. All variables and parameters, i.e., inventories, losses, accessions, selectees, promotion rates, and continuation rates, may be selected from the same

20

data file. The user may also select two or more files representing different years of data in which case all the variables and parameters will be averaged over the files selected.

Another option also available is to select different parameters from different files. If the user wanted to use the 1989 inventories and then forecast using the 1985 promotion and continuation rates, this option is also available.

2. **Changing the Data.**

Once the data has been selected, the user may decide to modify any item of data. For example, if the 1985 promotion rates were selected, and the user wanted to adjust the promotion rate for just the commanders with 14 years of service, the model will facilitate that change. This flexibility allows the manpower planner to develop and test any number of scenarios using both historical rates and planned or projected rates.

3. **Forecasting Inventories.**

Before the user actually forecasts inventories, he must decide how the continuation rates will be applied to the promotion rates. As stated in the working definitions, the promotion rates are computed by the number of officers selected, divided by the inventory of officers with the same years of service. The rate therefore, is actually a <u>selection</u>

21

rate, not a promotion rate. Not everyone who is selected for promotion remains on active duty until promoted.

To adjust for those promotable officers who choose to leave, the model will prompt the user to decide whether or not to multiply the promotion rate by the continuation rate. This will lower the promotion rates, thereby reducing the projected number of officers to the next paygrade. But, by applying the continuation rates to the promotion rates, there is an implicit assumption that the officers selected for promotion leave the system at the same rate as all other officers with the same years of service. (See Appendix F for additional information regarding this option.)

Once this decisions is made, the user may forecast inventories for one to ten years. The model will allow the user to select any one of these projected years and display the forecasted inventories. The user may also "piggy-back" on these results by replacing the current inventories with any one of these projected inventories and then repeating the process. Procedures for saving projected inventories for future use is described in Appendix F, "The Force User's Guide".

B. THE MEDICAL SERVICE CORPS DATA

Data from fiscal years 1985 through 1989 were obtained from the Bureau of Medicine and Surgery Information System (BUMIS) database which is maintained by the Medical Data Service Center, Bethesda, MD. Appendix A contains information

on extracting beginning inventories, accessions, losses and promotion data from the BUMIS data tapes. Appendix B provides detailed information on how the data was merged and modified to correct for missing year groups.

C. TREND ANALYSIS OF THE DATA

1. Inventory and Accession Trends.

Prior to forecasting the effects of any policy, it is beneficial to step back from the problem and the alternative scenarios and examine the past. History may not always repeat itself, but a thorough review of the past trends may shed some light on the future. Much of what we predict is based on the intuition and experience we gained from what has happened before.

Graphs of the beginning inventories for fiscal years 1985 through 1989 did not provide any significant information relative to the force reduction analysis, however, the 1989 beginning inventory of Medical Service Corps officers is displayed in Figure 3.1. What is significant are the large inventory spikes for the 1977 and 1973 year groups. These two year groups will provide a much different impact on promotions as they move into the zone than the year groups on either side of these spikes. A similar graph of the 1985 inventory data revealed that the two year groups, 1977 and 1973, have more officers than any other year group from 1955 to 1984.

Also noteworthy in Figure 3.1 is the relatively small inventory in the 1987 year group. Accessions for fiscal year

MSC INVENTORY
1989

Number of Officers

[Bar chart showing Number of Officers (y-axis, 0 to 250) by Year Group (x-axis, labeled 88, 86, 84, 82, 80, 78, 76, 74, 72, 70, 68, 66, 64, 62, 60, 58)]
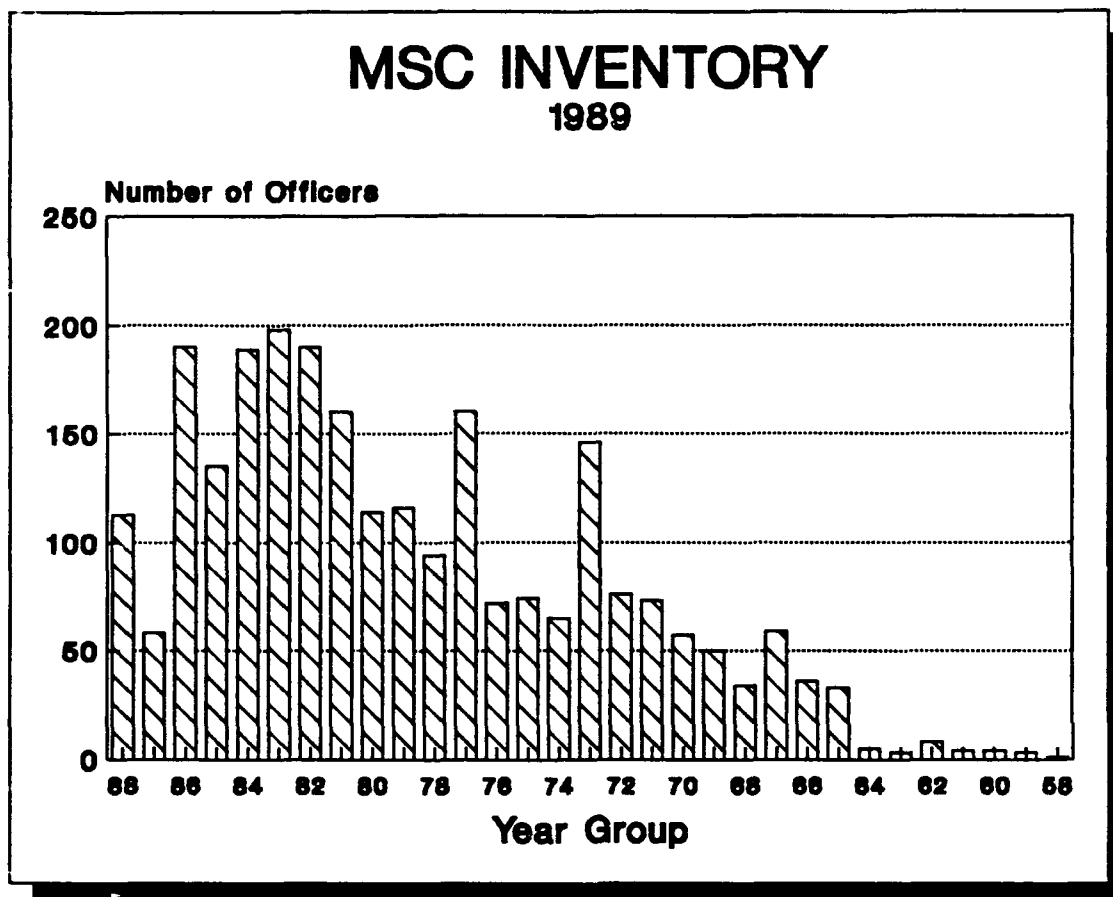
Year Group

FIGURE 3.1 Beginning Inventories by Year Group

1987 were about half of the average number per year over the five years reviewed. Figure 3.2 displays the number of accessions for fiscal years 1985 through 1989.

2. **Promotion Trends.**

The focus of this analysis is on the effects of a force reduction on promotions. Therefore, a close examination of the past five years of the promotion rates will establish a base from where to begin.

The Medical Service Corps data was examined in the aggregate, and also divided into Health Care Administration

24

Accession Trend
Fiscal Years 1985 - 1989

Number of Accessions

```
400 ┤
    │                                    342
360 ┤         332  ·················································
    │
300 ┤         ▨
    │                                    246        248.8
260 ┤                              ·········         ········
    │   215                        ▨          ▨
200 ┤   ▨     ▨                    ▨          ▨
    │   ▨     ▨                    ▨          ▨
160 ┤   ▨     ▨                    ▨          ▨
    │   ▨     ▨    110             ▨          ▨
100 ┤   ▨     ▨    ▨               ▨          ▨
    │   ▨     ▨    ▨               ▨          ▨
 60 ┤   ▨     ▨    ▨               ▨          ▨
    │   ▨     ▨    ▨               ▨          ▨
  0 └───────────────────────────────────────────────
      85    86    87    88    89         Average
                  Fiscal Years
```
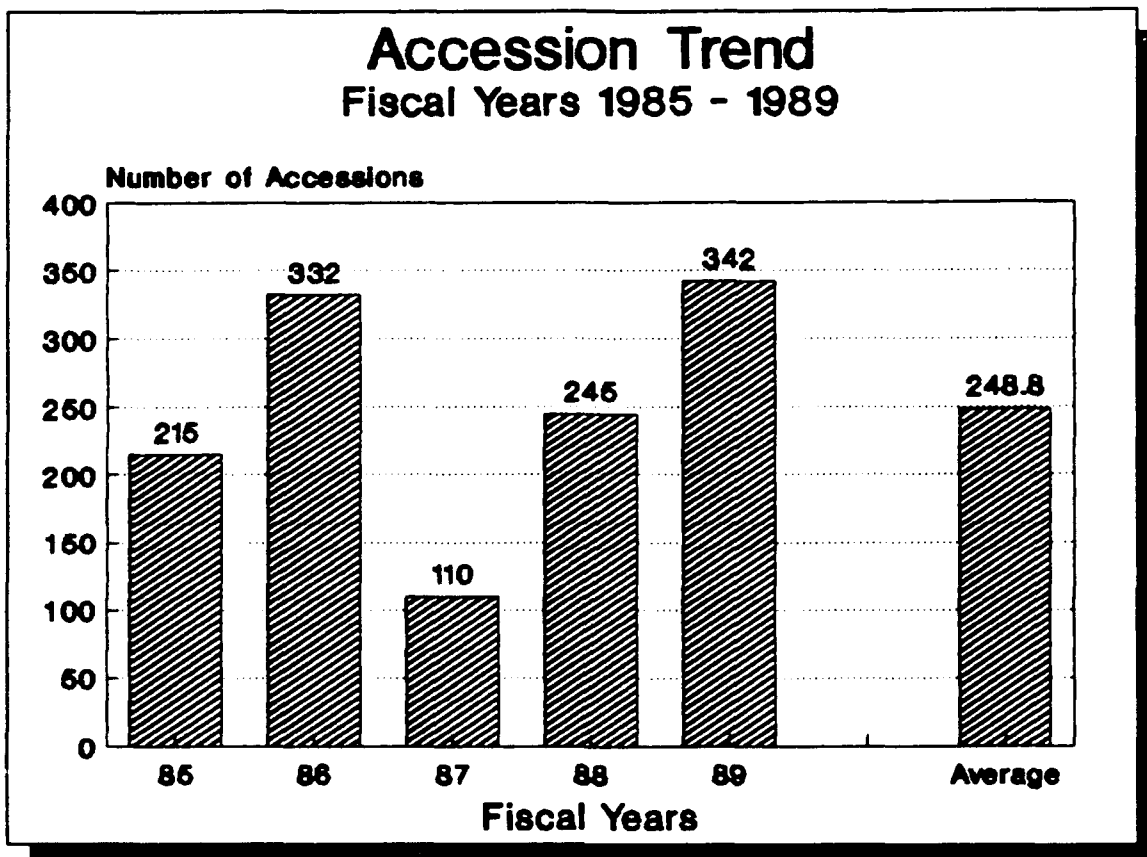
FIGURE 3.2 Accessions for Fiscal Years 1985 through 1989

and Health Science subcommunities. The next three figures (3.3, 3.4 and 3.5) display the trend in the aggregate promotion rates into the three control grades.

Figure 3.3 presents the promotion rates from lieutenant to lieutenant commander by years of service. As explained in Chapter 2, Section D.7., this rate is determined by the number of officers selected for promotion divided by the inventory of officers with the same years of service. In 1985, a portion of the lieutenants were selected for promotion at eight years of service. In 1986, no one was selected at

25

AGGREGATE TREND
LT TO LCDR FLOW POINT

Rate

Number selected for promotion divided by the inventory of officers with the same years of service

0.8
0.6
0.4
0.2
0

1985   1986   1987   1988   1989

Fiscal Years 1986 - 1989

FY minus Year Group

■ 8 YOS   ░░ 9 YOS   ▒▒ 10 YOS
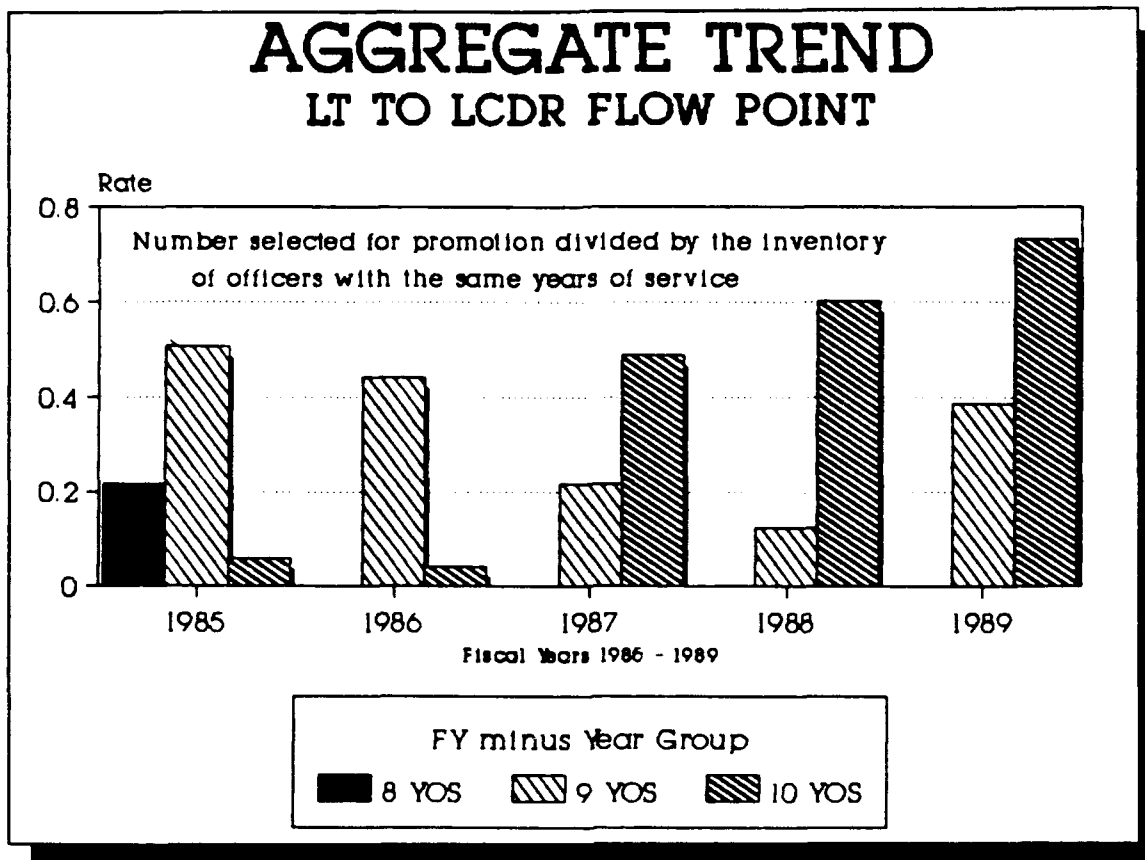
FIGURE 3.3 MSC Promotion Trend to Lieutenant Commander

eight years, while the majority of the officers selected had nine years of service. By 1987, and into 1989, most selectees to lieutenant commander had ten years of service.

The next diagram, Figure 3.4, displays the promotion rates from lieutenant commander to commander by years of service. In 1985, a small portion of the selectees to commander had only 13 years of service. By 1989, most had 15 years of service and some had 16 years of service. Again, the trend is toward more years of service prior to promotion. This shift is not unexpected, however, as one of the goals of

AGGREGATE TREND
LCDR TO CDR FLOW POINT

Rate

Number selected for promotion divided
by the inventory of officers
with the same years of service

0.7
0.6
0.5
0.4
0.3
0.2
0.1
0

1985   1986   1987   1988   1989

Fiscal Years 1985 - 1989

FY minus Year Group

▮ 13 YOS   ▨ 14 YOS   ▤ 15 YOS   ▨ 16 YOS
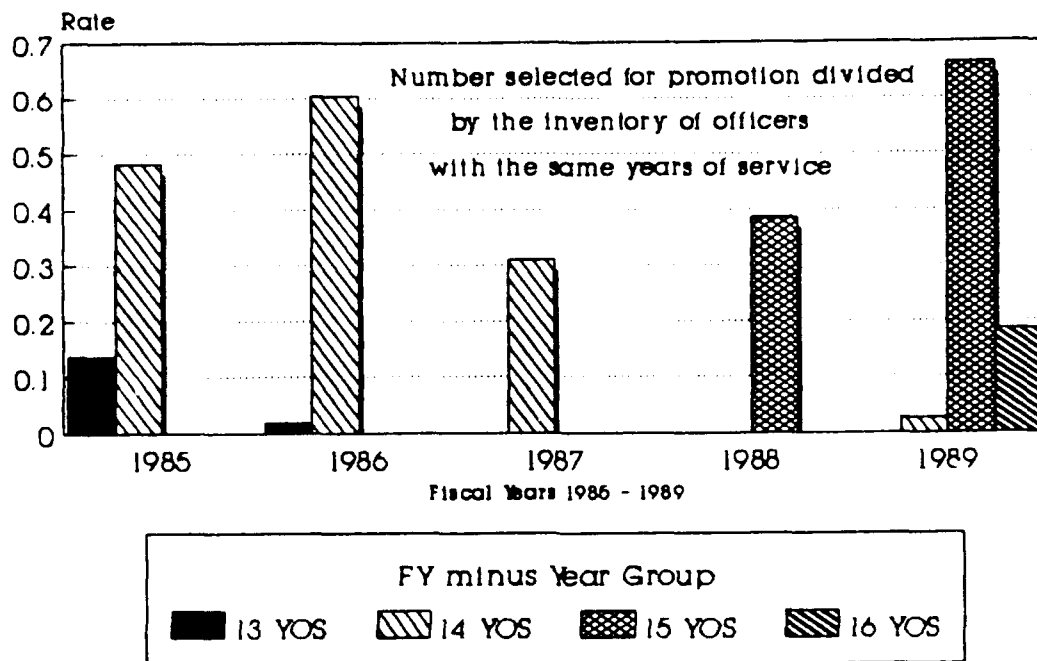
FIGURE 3.4   MSC Promotion Trend to Commander

DOPMA was to move the flow points to ten, 16 and 22 years of service respectively for the three control grades. This shift in the flow point over the past five years is evidence of the fact that the promotion opportunity, the size of the promotion zone, and the flow point can be adjusted by policy makers to achieve a desired force structure.

The promotion trend to captain, displayed in Figure 3.5, is very different from that of the previous two ranks. In 1985, most selectees to captain had 19 years of service. From 1986 to 1987, the flow point moved toward 20 years of

27
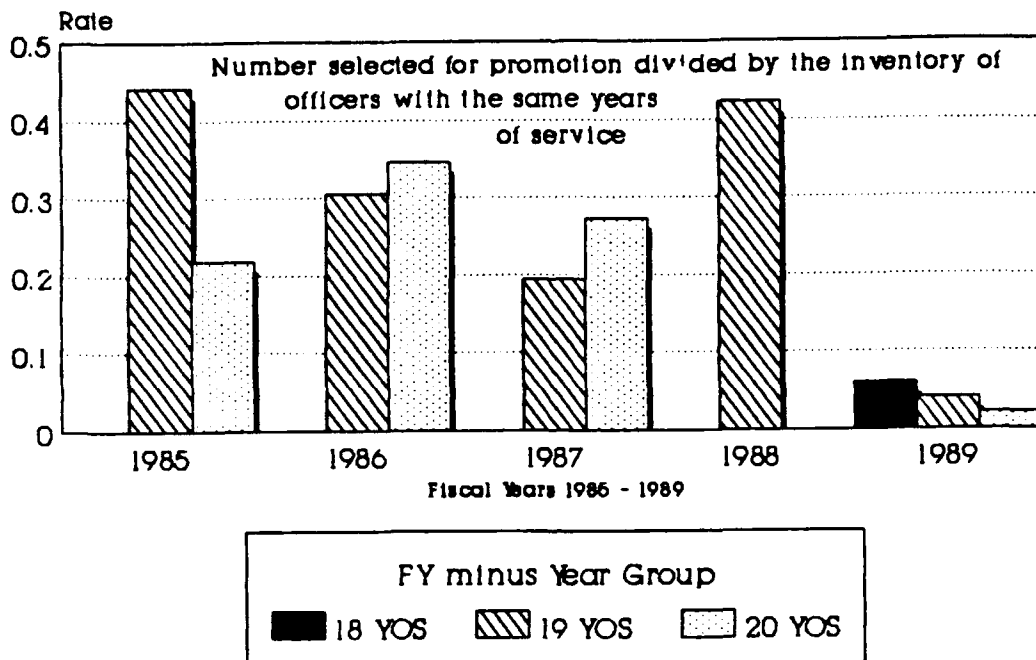
FIGURE 3.5 MSC Promotion Trend to Captain

service and then returned to 19 years of service by 1988. Interestingly, in 1989, some of the selectees for captain had only 18 years of service, although this represents a very small percent of the selectees. Twenty six officers were selected for captain in 1989, three of those officers, or 11% had 18 years of service.

The promotion **rate** used in the model is not easy to compare from one year to the next. Because selectees are taken from more than one year group, it is difficult to relate the rates over two or three year groups to the actual

28

promotion opportunity or the flow point. Therefore, the next three figures are presented to compare the actual number of selectees at each year of service with the inventory of officers with the same years of service. Figures 3.6, 3.7 and 3.8 exhibit the promotion trends from lieutenant, lieutenant commander and commander, respectively.

Lieutenant Promotion Trend
Lieutenant to Lieutenant Commander

Actual number

Years of Service.....	8	9	10	9	10	9	10	9	10	9	10
Inventory	208	74	17	156	24	101	86	122	88	114	97
Selectees	45	38	1	69	1	22	42	15	53	44	71
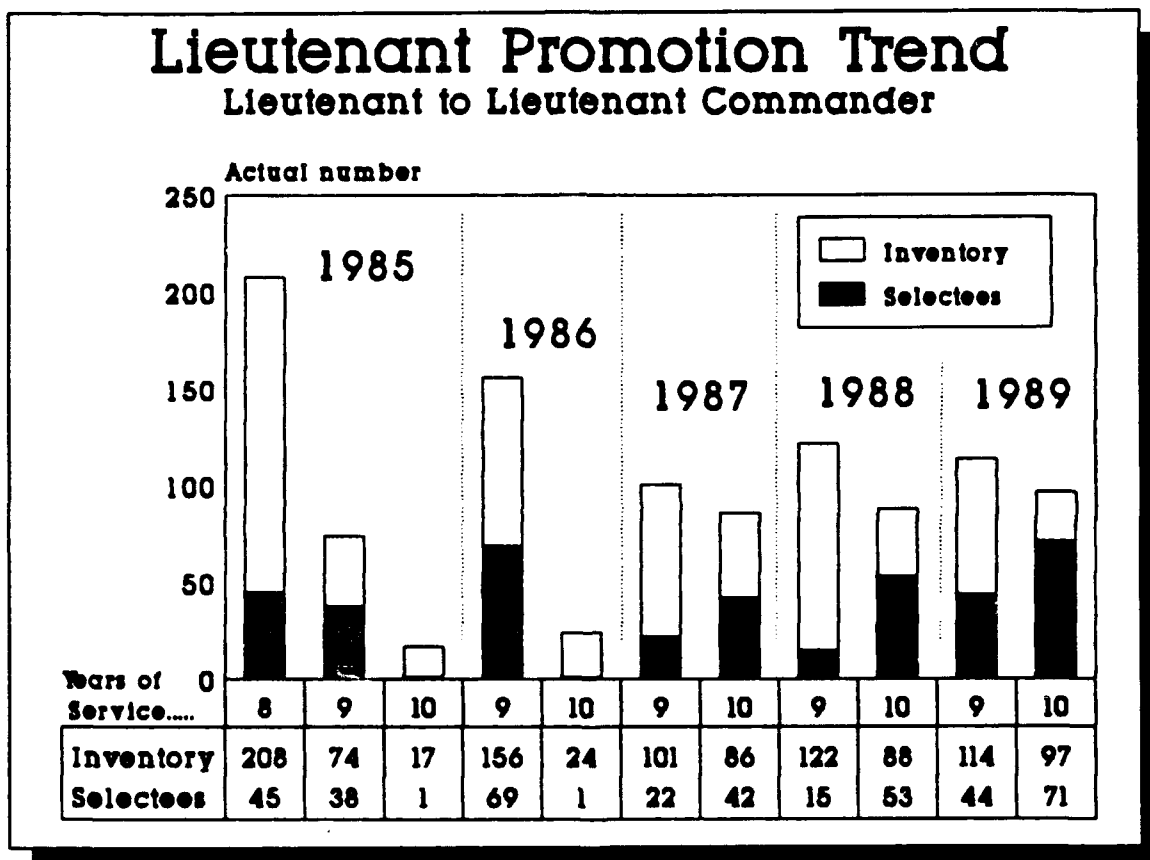
FIGURE 3.6   Selectees vs Inventory: Promotion from Lieutenant to Lieutenant Commander.

These three graphs could be used to compute the percent of officers at each year of service who were actually selected. For example, in 1985, 44 officers were selected for commander. Thirty one of these officers, or 70 percent had 14

29

Lieutenant Commander Promotion Trend
Lieutenant Commander to Commander

Actual number

Years of Service.....	13	14	13	14	14	15	14	15	16
Inventory	95	64	165	78	158	101	74	65	54
Selectees	13	31	3	47	49	38	2	43	10
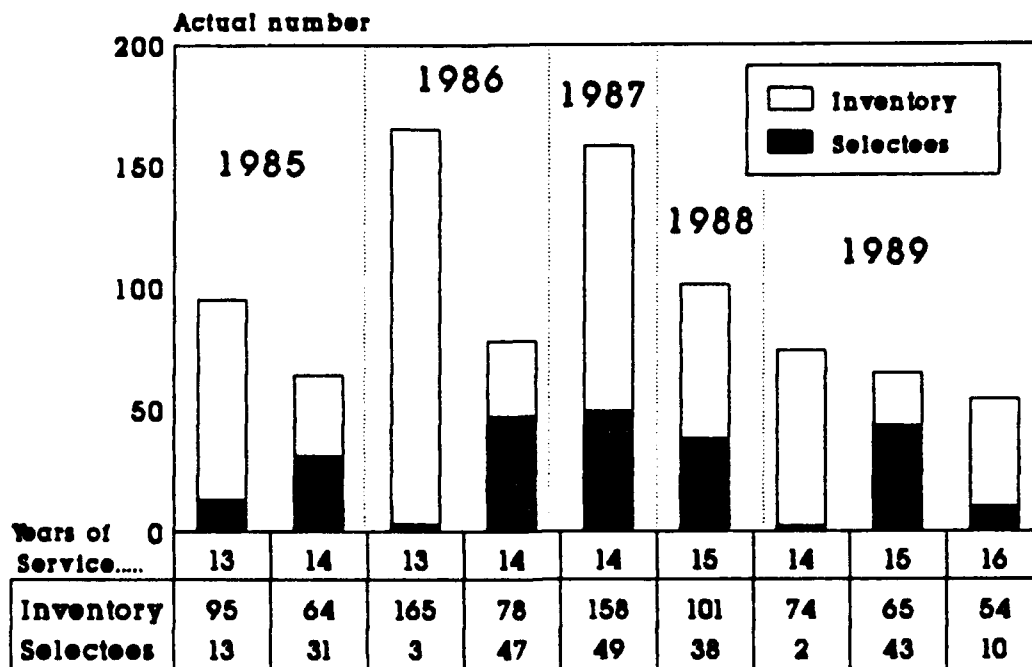
FIGURE 3.7 Selectees vs Inventory: Promotion from Lieutenant Commander to Commander

years of service. In 1989, 55 officers were selected for commander and only two, or 3.6 percent, had 14 years of service.

D. COMPARISON OF HEALTH CARE ADMINISTRATION AND HEALTH SCIENCE PROMOTION FLOW POINTS

A question is often raised as to whether a Health Care Administration (HCA) officer is promoted faster than a Health Science (HS) officer. As illustrated in Figure 3.9, in 1985, some HS officers waited until 10 years of service for promotion to lieutenant commander while all HCAs were promoted

Commander Promotion Trend
Commander to Captain

Actual number

Years of Service....	19	20	19	20	19	20	19	18	19	20
Inventory	52	32	62	26	31	44	45	51	45	24
Selectees	23	7	19	9	6	12	19	3	18	5

Legend: Selectees, Inventory

Years labeled: 1985, 1986, 1987, 1988, 1989
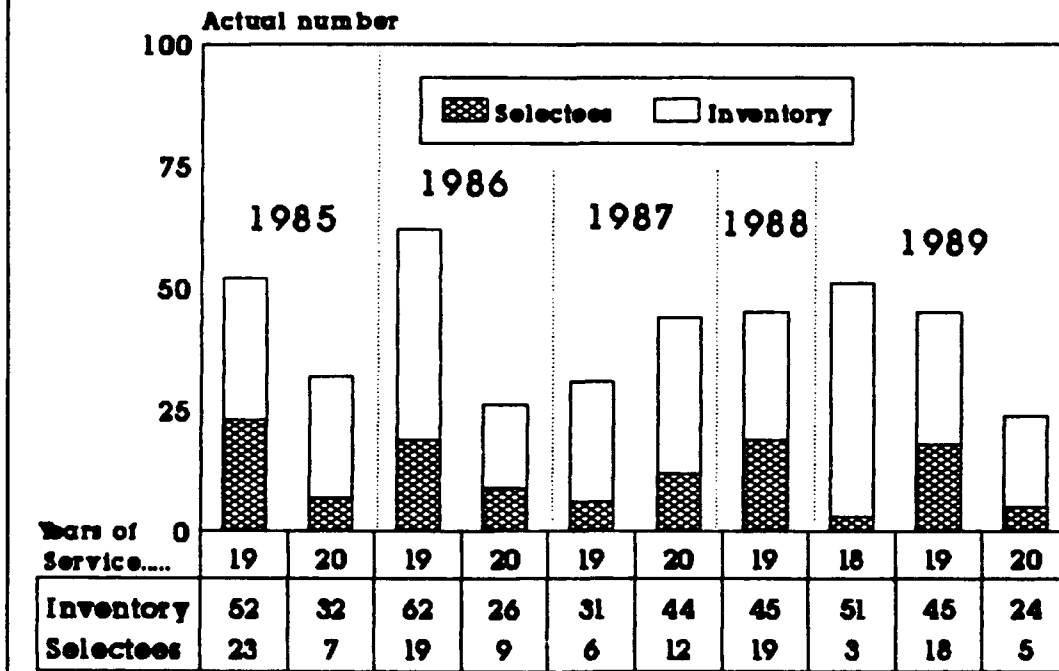
FIGURE 3.8   Selectees vs Inventory: Promotion from
Commander to Captain

at either eight or nine years of service. In the same fiscal
year, all HS officers selected for commander had 14 years of
service, while a portion of the HCA officers were selected for
commander with only 13 years of service. The trend was
reversed for promotion to captain, where a larger portion of
the HS captain selectees had only 19 years of service; most
HCAs had 20 years of service.

In 1986, 1987 and 1988, the promotion rates at all three
control grade flow points were almost equal for the two

31

PROMOTION RATES
1985

Rate: No. selected/inventory of officers with same YOS

TO LCDR

TO CDR

TO CAPT

Year of Service for Promotion
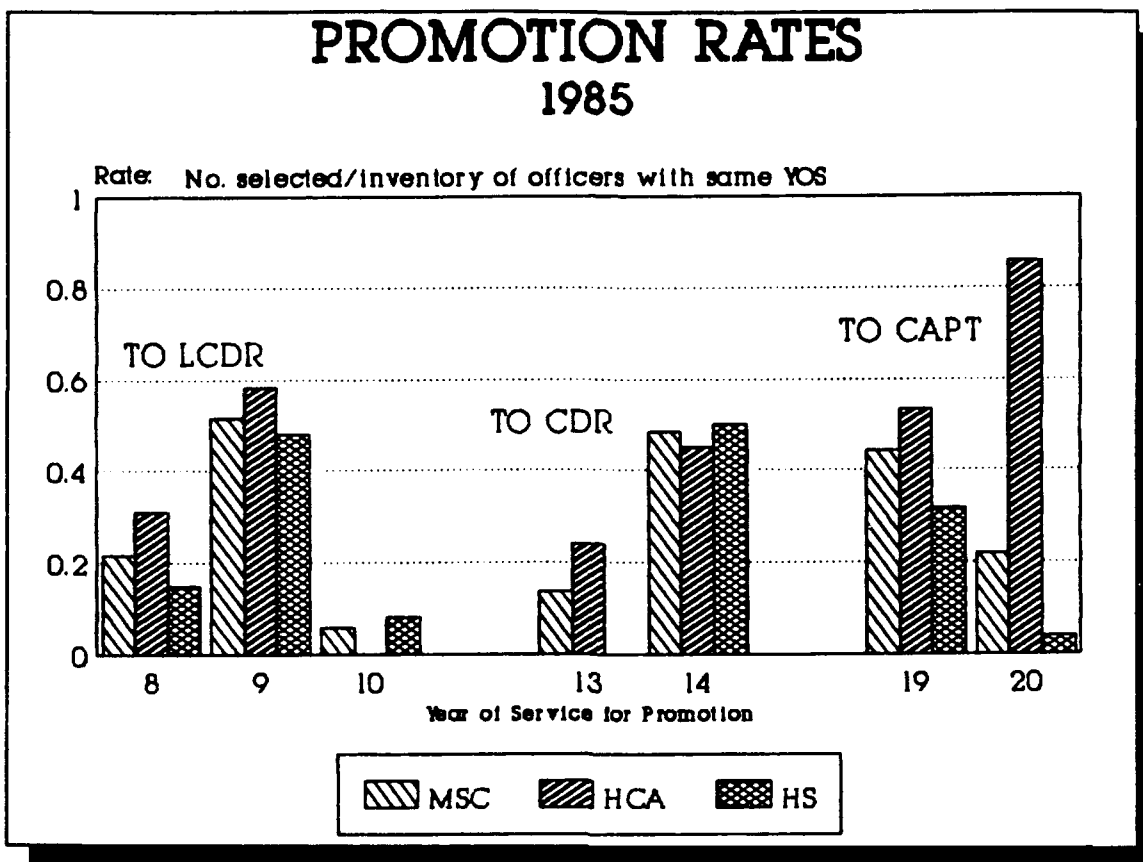
MSC   HCA   HS

FIGURE 3.9 Comparison of MSC, HCA, and HS Promotion
Rates for 1985.

subcommunities. These comparisons are displayed in Figures
3.10, 3.11 and 3.12.

Figure 3.13 displays the 1989 flow points. In 1989, all
HS officers selected for promotion to commander had either 14
or 15 years of service. A portion of the HCA officers had 16
years of service. In this same fiscal year however, some HCA
officers were selected for promotion to captain with only 18
years of service while all HS officers had either 19 or 20
years of service.

PROMOTION RATES
1986

Rate: No. selected/inventory of officers with same YOS

TO CDR

TO LCDR

TO CAPT

Year of Service for Promotion
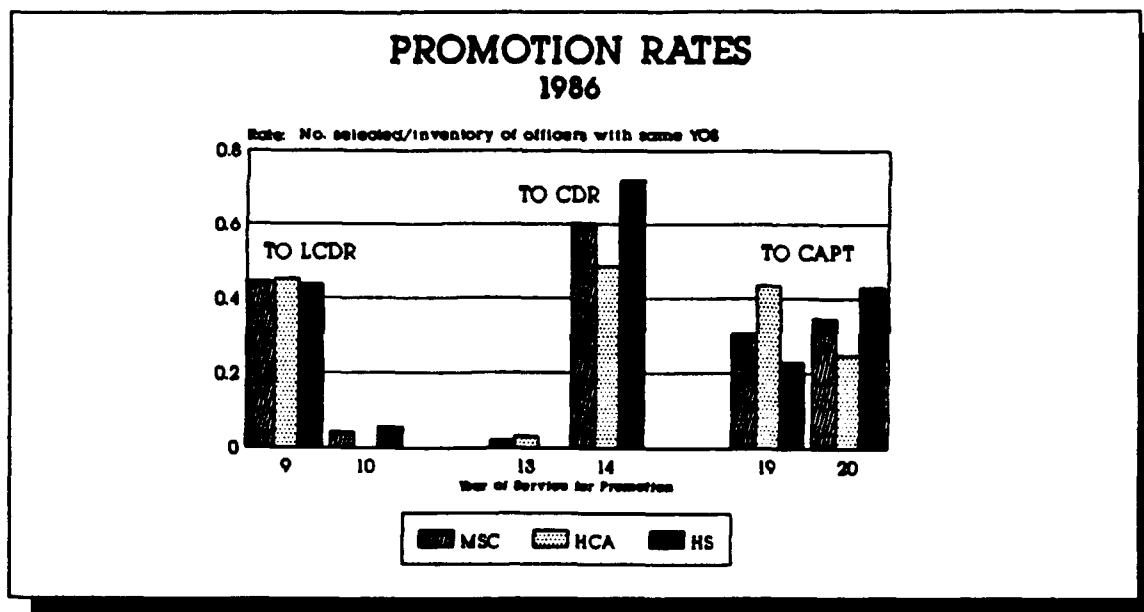
MSC   HCA   HS

FIGURE 3.10 Comparison of MSC, HCA and HS Promotion Rates in 1986.

PROMOTION RATES
1987

Rate: No. selected/inventory of officers with same YOS

TO LCDR

TO CDR

TO CAPT

Year of Service for Promotion
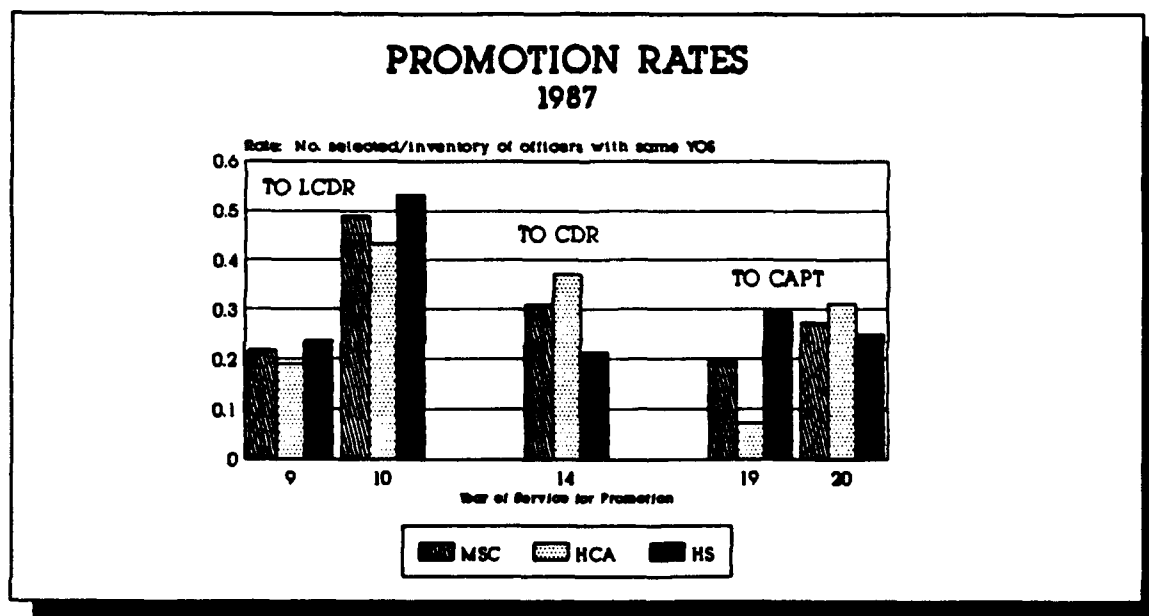
MSC   HCA   HS

FIGURE 3.11 Comparison of MSC, HCA and HS Promotion Rates for 1987

33
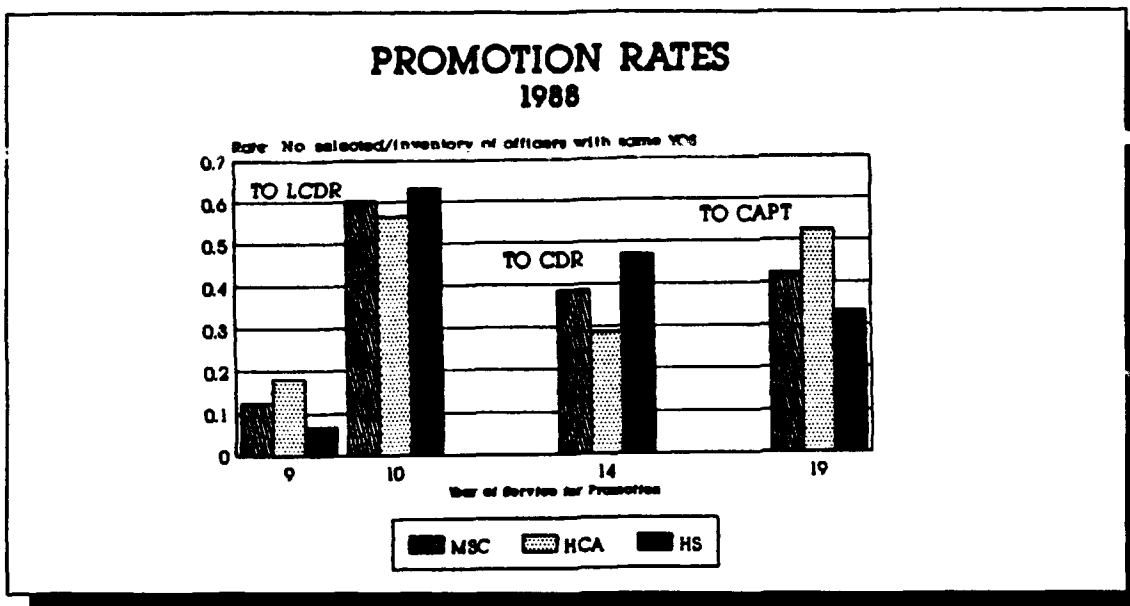
FIGURE 3.12 Comparison of MSC, HCA and HS Promotion Rates for 1988
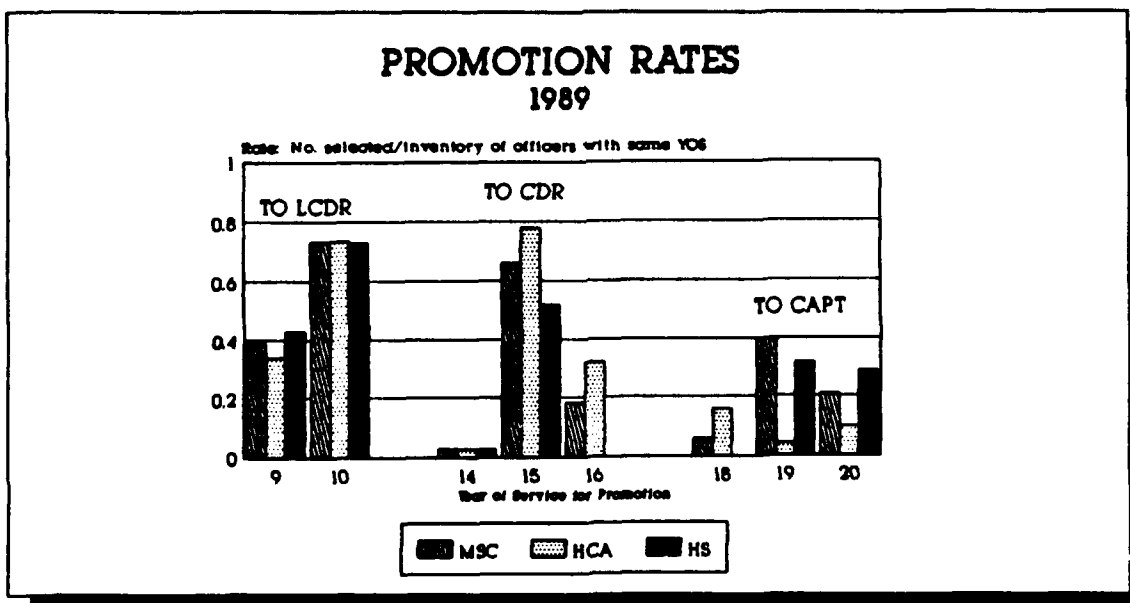
FIGURE 3.13 Comparison of MSC, HCA and HS Promotion Rates in 1989.

34

Again we see some difficulty in interpreting the rates.
Because the rate is computed by selectees over inventory, the
denominator in each rate is different and does not allow for
a direct comparison between the HCA and HS rates. As such,
Table 3.1 provides the mean years in service for HCA and HS
officers for promotion to lieutenant commander, commander and
captain.

TABLE 3.1 MEAN YEARS OF SERVICE FOR PROMOTION: COMPARISON OF
HCA AND HS OFFICERS FROM 1985 THROUGH 1989.

Fiscal Year	Promotion to	HCA (YOS)	HS (YOS)
1985	LCDR	8.34	8.60
	CDR	13.41	14.00
	CAPT	19.27	19.13
1986	LCDR	9.00	9.02
	CDR	13.86	14.00
	CAPT	19.23	19.40
1987	LCDR	9.67	9.65
	CDR	14.00	14.00
	CAPT	19.83	19.58
1988	LCDR	9.67	9.88
	CDR	15.00	15.00
	CAPT	19.00	19.00
1989	LCDR	9.67	9.56
	CDR	15.23	14.94
	CAPT	18.87	19.36

In summary, we see the effects of the DOPMA regulations
on the flow points in the Medical Service Corps and a gradual
increase in the years of service for promotion into the three
control grades. The actual number of selectees by grade and
years of service was presented along with the beginning

inventory of officers at the control grade flow points for
each of the fiscal years 1985 through 1989.

Finally, a brief comparison of the MSC officer promotion
trend to both the HCA and HS officers promotion trend was
presented and the mean years to promotion were computed for
each of the two subcommunities.

IV. TESTING THE FORCE REDUCTION SCENARIO
WITH AGGREGATE DATA

A. ESTABLISHING THE PARAMETERS

1. Continuation Rates

Before forecasting future inventories, a decision must be made regarding the parameters, i.e., the continuation rates, promotion rates and the number of accessions to be used with the model. The continuation rate was the first parameter examined using the past five years of data.

The first question to be answered is whether it is appropriate to use the average rates over the last five years. A cursory review of the rates may suggest that averaging is acceptable; more careful examiniation showed that this was not the case.

The continuation rates for fiscal years from 1985 through 1989 were averaged, and the standard error was computed. Each of the yearly rates was then measured against the band of possible values, plus or minus one standard error from the average. The results of these calculation showed that averaging the past five years of continuation rates was not acceptable. Only three out of 40 lieutenant continuation rates, 13 out of 55 lieutenant commander rates and 6 out of 40 commander continuation rates fell within one standard error of the average. However, a decision was made to average the rates over the past two years. These continuation rates used

37

in the model to forecast future inventories are listed in Appendix E.

2. Promotion Rates

The promotion rates, unlike the continuation rates, are seldom appropriate to be averaged over past years. The promotion rates and the promotion flow points are often adjusted by the policy makers to maintain the desired force structure. When the promotion zone is established, it seldom includes only one year group of officers. Because the size of the zone, the inventory of officers in each year group and the years of service of those officers in the zone will vary from one year to the next, it is not advisable to average promotion rates.

For example, in 1985, some officers were sel cted for promotion to lieutenant commander with only eight years of service, but none were selected at eight years of service for the next four years. In 1985, most officers were selected for commander at 13 or 14 years of service, but, by 1989, the commander flow point was somewhere at 15 to 16 years of service.

A decision was made to use the DOPMA promotion opportunity percentage (listed in Table 2.1) at the promotion flow points as a proxy for the promotion rates into the control grades. The projected flow points were taken from the

38

FY-91 Officer Grade Promotion Plan developed in 1989 [Ref. 14]. Table 4.1 presents the flow points used in the analysis for FY-91 through FY-95 for the three control grades.

TABLE 4.1 FLOW POINT ESTIMATES FOR MSC PROMOTIONS IN 1991 THROUGH 1995

PROMOTION FROM/TO	1991	1992	1993	1994	1995
LT -> LCDR	10 YOS	10 YOS	10 YOS	10 YOS	10 YOS
LCDR -> CDR	16 YOS	15 YOS	16 YOS	16 YOS	16 YOS
CDR -> CAPT	20 YOS	20 YOS	21 YOS	21 YOS	21 YOS

Source: FY-91 Officer Grade Promotion Plan prepared by OP-093 on 28 August 1989.

The flow points to lieutenant junior grade and lieutenant have not changed drastically over the past five years. Therefore, to remain consistent with the method used in estimating the continuation rates, the promotion rates for these two grades were averaged over the last two years. These rates are also displayed in Appendix E.

3. **Accession Proportions**

The actual number of accessions will be adjusted to meet the end strength targets. The primary concern in establishing this parameter is not the number of accessions, but the distribution of these accessions across the various grades and years of service. Because the Medical Service Corps grants constructive credit and service credit to many of the new accessions, and officers enter with varying grades and

39

years of service, a decision had to be made about the potential rank and constructive credit of future accessions.

Once again, averaging was considered over the fiscal years 1985 through 1989. The first step was to average the number of accessions per grade and years of service combination.

Table 4.2 displays the eleven grade and years of service combinations and the corresponding average accession proportions which account for 99 percent of all accessions over the past five years. The remaining one percent was spread among several other categories which were not consistent from year to year.

TABLE 4.2 AVERAGE ACCESSION DISTRIBUTION FROM 1985 THROUGH 1989.

GRADE	YEARS OF SERVICE	AVERAGE PROPORTIONS
1	1	.343
1	2	.023
2	1	.012
2	2	.129
2	3	.183
2	4	.015
3	4	.052
3	5	.136
3	6	.053
3	7	.032
3	8	.013
	TOTAL %	0.99

The above average proportions can now be multiplied by any number of accessions resulting in an appropriate distribution of the accessions. For example, if next fiscal year's accessions were projected to be 200, then the resulting ensigns with one year of service would be 200(.343) = 68.6; ensigns with two years of service would be 200(.023) = 4.6, etc.

The accession proportions were averaged over fiscal years 1985 through 1989 to obtain the accession distribution vector shown in Table 4.2. However, the same question can be asked about the appropriateness of averaging accession proportions that was raised about averaging continuation rates. Therefore, the same statistical test that was used for all continuation and some promotion rates was performed on the individual accession proportions to determine if the average is an acceptable estimate in this case.

With eleven grade/YOS combinations and 5 years of data, 55 rates were examined. Only six of these rates, or approximately 11 percent, fell _outside_ one standard error of the average. Based on these results, the average accession proportions in Table 4.2 were used with the model.

B. RESULTS OF THE MSC SCENARIO

The most current data available at the time this analysis was conducted was for the fiscal year 1989. The beginning inventories, accessions, promotions and losses from 1989 were used to construct the beginning inventory for 1990. It is

from this point, that the analysis begins. To the extent that these data were quite accurate, the projected FY 1990 beginning inventory constructed this way should be very close to the actual values. The constructed FY 1990 inventory is presented in Appendix E.

The goal of the MSC scenario is to forecast force structures assuming a three percent reduction in end strength per year for each of five consecutive years. Therefore, the reductions are to be accomplished entirely by cuts in accessions.

The projected FY 1990 beginning inventory is 2,665 officers, distributed in the following ranks:

Ensigns	137
Lieutenant Junior Grade	273
Lieutenant	1,184
Lieutenant Commander	588
Commander	329
Captain	154

When this analysis began, 1989 was the last year of data available. By the time this thesis is released, the beginning inventories for fiscal years 1990 and 1991 will become available. Thus, the FY 1990 starting inventory as well as the FY 1991 target inventory may turn out to be slightly different from those presented in this thesis. Nonetheless, the method demonstrated by this analysis is still valid.

It is important to emphasize that it is not the actual inventory numbers that is the focus of this analysis. The objective is to demonstrate a tool that could be used to test the impact of various policy decisions on future force

42

structures. Theoretically, five years of reduced accessions should create a gap in the force structure. The focus of this analysis is to determine if a gap will develop during a five year period of reductions, and if a gap develops, what impact this gap may have on future promotion flow points. The beginning strength targets used in the analysis for five years are displayed in Table 4.3.

TABLE 4.3 BEGINNING STRENGTH TARGETS FOR FY-91 THROUGH FY-95

FISCAL YEAR	3 % REDUCTION	BEGINNING OF THE YEAR TARGET
1991	-80	2,585
1992	-78	2,507
1993	-75	2,432
1994	-73	2,359
1995	-71	2,288

As described in Chapter 2, Section D.8, the force structure can be likened to a system of personnel entering mostly at the bottom end and exiting mostly at the top end. If for several years the system were allowed to continue losing personnel and the in-flow of personnel were severely decreased, the overall size, or the total number of personnel in the system, would decrease.

Thus, the objective is to hold the number of losses, or the continuation rates, steady, and reduce the number of

accessions each year in order to meet the decreasing beginning strength numbers listed in Table 4.3 above.

The number of 1990 accessions required to meet the 1991 beginning inventory target is 145 officers. This number was determined by using the model to forecast one year _without_ any accessions, using the 1990 inventory and the continuation and promotions rates described in Section A. The projected inventory would then be 2,440 officers. Thus, 145 accessions would be required to meet the 1991 target of 2,585 officers listed in Table 4.3. By applying the accession proportions (explained in Section A.3), the distribution of these 145 officers was determined as presented in Table 4.4.

TABLE 4.4 ACCESSIONS IN 1990 REQUIRED TO MEET THE 1991 BEGINNING INVENTORY TARGET

YOS	ENS	LTJG	LT
1	50	1	
2	3	19	
3		27	
4		2	8
5			20
6			8
7			5
8			2

The targets for the next four fiscal years, 1992-1995 were also met by appropriately adjusting the number of accessions. In 1991, 140 accessions were necessary to meet the 1992

beginning inventory target. Table 4.5 displays the accessions required for each of the five years of reductions.

After projecting the inventories through the five years of three percent force reductions, some assumptions had to be made for the next five to ten years. The assumption made was that the force structure would remain constant at the 1995 target of 2,288. All further projections were based on this assumption.

TABLE 4.5   ACCESSIONS REQUIRED IN 1990 THROUGH 1994 TO MEET
THE BEGINNING INVENTORY TARGETS IN TABLE 4.3

ACCESSION YEAR	NUMBER OF ACCESSIONS REQUIRED	TARGET FOR FOLLOWING FISCAL YEAR
1990	145	2,585
1991	140	2,507
1992	120	2,432
1993	145	2,359
1994	130	2,288

The potential void in the force structure created by five years of reduced accessions will not impact on the control grade promotion flow points for several years. Therefore, to investigate this potential impact, the forecasting of inventories was continued for an additional five to ten years. By the year 2000, the first of the officers accessed during the period of reduction will be reaching eight to ten years of service.

Table 4.6 displays the projected inventory of lieutenants with four to twelve years of service for fiscal years 1985 through 2004.

TABLE 4.6 PROJECTED INVENTORY OF LIEUTENANTS FROM 1985
THROUGH 2004 WITH 4 THROUGH 12 YEARS OF SERVICE

YEARS OF SERVICE

	4	5	6	7	8	9	10	11	12
FY									
1985*	147	137	149	129	208	74	17	0	2
1986*	126	173	139	145	111	156	24	6	0
1987*	167	191	182	135	127	101	86	15	1
1988*	146	205	190	174	123	122	88	25	4
1989*	120	185	198	190	160	114	97	19	12
1990	177	165	194	213	178	143	68	24	17
1991	92	197	162	190	192	161	136	10	16
1992	172	109	194	160	171	174	154	20	7
1993	155	184	109	189	144	155	166	22	13
1994	93	171	180	109	170	130	148	24	15
1995	92	109	167	176	99	154	124	22	16
1996	90	118	113	,7	160	90	147	18	15
1997	110	118	122	115	152	145	86	21	12
1998	117	135	121	124	105	138	138	13	14
1999	138	140	136	122	113	95	132	20	9
2000	137	162	142	137	112	102	91	19	13
2001	133	161	162	142	125	101	97	13	13
2002	129	157	161	162	129	113	96	14	9
2003	132	153	158	160	146	117	108	14	9
2004	133	156	153	157	145	132	112	16	9

* Represents actual data from the BUMIS data file. All other data are projected inventories

46

The first diagonal set of shaded blocks represents the 1987 accessions as they reach the 8th, 9th and 10th years of service. The next three diagonal sets of shaded blocks are from the accessions of fiscal years 1990, 1991 and 1992 as they reach the 8th, 9th and 10th years of service.

If the flow point to lieutenant commander remains at ten years of service, the question becomes whether the reduce inventory of officers at this flow point will be sufficient to meet the promotion requirements? In fiscal year 2000, there are only 91 officers with ten years of service. If lieutenant commander vacancies remain close to those from 1985 through 1989, then approximately 100 officers should be in zone each year to fill an average of 80 vacancies. With only 91 officers at the flow point, the lieutenant commander zone in FY 2000 will have to include officers with nine years of service.

If the inventory at the flow point was reduced only for one year, like it is forecasted for 1997, the requirement to include officers with fewer than ten years of service should not present a problem. As we can see in Table 4.6, there are 145 officer following at nine years of service. Even if a portion of these officers with nine years of service are included in the 1997 promotion zone, there should still remain a sufficient number of officers to support the flow point at ten years of service in FY 1998.

The major problem with the five consecutive years of reduced accessions is that the larger follow-on inventories will not be there. For instance, in FY 2000, there are only 102 officer with nine years of service and in 2001 there are only 101 officers with nine years of service.

Another question may be asked about the accessions of fiscal years 1993 and 1994. Table 4.6 shows smaller inventories at the flow point for only the first three years of the force reduction period, those of the accessions in fiscal years 1990, 1991 and 1992.

In 1996 the reductions stop, and the force is being held steady at the final target of 2,288. Because the reductions have stopped, accessions will first increase and then level off to maintain the fixed end strength of 2,288.

Table 4.7 displays the numbers of accessions for the fiscal years 1995 through 2009.

The accessions in 1995 will produce officers with year groups of 1987 through 1995 since, as Table 4.2 shows, officers with two or three years of constructive credit make up a large portion of the accessions. When the number of accessions returns to around 200 in 1995, over 30 percent of these new officers will be designated with year groups of 1993, 1994 and 1995, thus, increasing the inventory for those year groups and softening the blow from the earlier force reductions.

TABLE 4.7 ACCESSIONS IN FY 1995 THROUGH 2009 TO MAINTAIN THE
BEGINNING INVENTORY TARGETS OF 2,288

ACCESSION YEAR	NUMBER OF ACCESSIONS	TARGET FOR FOLLOWING FISCAL YEAR
1995	205	2,288
1996	217	2,288
1997	203	2,288
1998	186	2,288
1999	196	2,288
2000	196	2,288
2001	197	2,288
2002	199	2,288
2003	194	2,288
2004	190	2,288
2005	194	2,288
2006	198	2,288
2007	199	2,288
2008	195	2,288
2009	195	2,288

The next logical question to be answered is what the
inventories will be like in five years, when these three years
of deficit inventory reach the flow point for commander.
Continuing with the forecasting using the same continuation
rates and promotion rates, the inventory was projected for
five more years using the model. Table 4.8 displays the
results of the lieutenant commander inventory forecasted to
the year 2009.

Here, the first set of diagonally shaded cells represent
the 1987 inventory as it reaches the 14th, 15th and 16th years
of service. The next three sets of diagonally shaded cells

TABLE 4.8 PROJECTED INVENTORY OF LIEUTENANT COMMANDERS FROM 1985 THROUGH 2009 WITH 11 THROUGH 17 YEARS OF SERVICE

YEARS OF SERVICE

FY	11	12	13	14	15	16	17
1985*	74	180	95	64	19	10	6
1986*	89	71	165	78	29	17	8
1987*	77	85	69	158	25	26	16
1988*	153	73	80	67	101	21	25
1989*	75	148	72	74	65	54	19
1990	85	74	139	70	67	21	36
1991	96	83	71	132	67	64	3
1992	109	93	79	67	125	17	53
1993	123	106	89	75	64	119	2
1994	133	120	101	84	71	61	15
1995	118	129	115	96	80	68	8
1996	99	115	123	109	91	76	9
1997	118	96	110	117	104	87	10
1998	69	115	92	104	111	99	11
1999	110	67	110	87	99	106	13
2000	106	108	64	104	83	94	13
2001	73	103	103	61	99	79	12
2002	78	71	98	98	58	94	10
2003	77	76	68	93	92	55	12
2004	86	75	73	64	88	89	7
2005	90	84	72	69	61	84	11
2006	101	88	80	68	66	58	11
2007	100	98	84	76	65	63	7
2008	98	97	94	80	72	62	8
2009	95	95	93	89	76	69	8

* Represents actual data from the BUMTR data file. All other data are projected inventories

50

represent the same year groups that were shaded in Table 4.6, namely those of the fiscal years 1990, 1991 and 1992.

The inventory at the commander flow point, (now at 16 years of service), in the fiscal years 2003, 2006, 2007 and 2008 is lower than the inventory of officers at the commander flow point of 14 years of service in 1985. (Refer to Figure 3.9 for the 1985 commander flow point).

The inventory numbers represented in Tables 4.6 and 4.8 demonstrate the projected decline of officers at the flow points for lieutenant commander and commander. The numbers suggest that the flow point may have to be shifted back toward nine years of service for lieutenant commander in the years 2000, 2001 and 2002, and fifteen years of service for commander selectees in the years 2006, 2007 and 2008. If the number of selectees per year is to remain constant, a shift backward to include earlier year groups would be necessary to keep the number of officers in the zone constant during these lean years.

C. FORCE REDUCTION EFFECTS ON AGGREGATE INVENTORIES

Looking at the number of officers at the flow point provides only half of the picture. Another issue to explore is the total number of officers in inventory, irrespective of their years of service. Figure 4.1 provides a representation of six years of total inventories (FY1985 through FY1990) for the six grades.

MSC INVENTORY*
By Grade

Number of officers

Fiscal Year		ENS	LTJG	LT	LCDR	CDR	CAPT
■ 1985	1985	50	268	863	591	308	83
▨ 1986	1986	65	293	881	600	306	103
▨ 1987	1987	119	296	1005	585	317	122
□ 1988	1988	34	291	1077	563	323	135
▨ 1989	1989	114	266	1095	575	322	148
▨ 1990	1990	137	273	1184	588	329	154
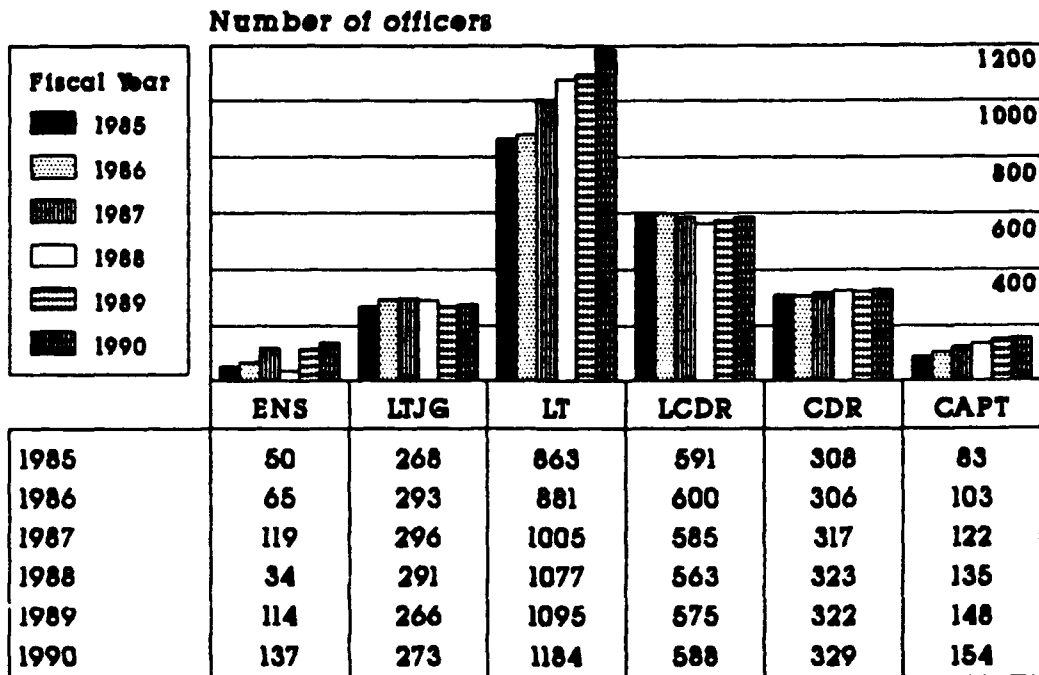
* Beginning Inventory

Figure 4.1 Aggregate MSC Inventory by Grade from 1985 through 1990 (1990 is projected inventory)

Over the years 1985 through 1990, both the lieutenant and captain inventories have continually increased in numbers, while the lieutenant commanders and commanders have remained relatively constant. By 1990, the ensign inventory has more than doubled from the 1985 inventory, although the numbers fluctuated greatly over past five years.

The next diagram, Figure 4.2, displays the projected grade sizes during the period of reduction from 1990 through 1995. Note the decline in the ensign, lieutenant junior grade and lieutenant grade sizes and the gradual increase in lieutenant

commanders. The grades of commander and captain remain relatively constant in size during this period.

The decline in the three junior officer ranks can be attributed to the five years of reduced accessions. The increase in lieutenant commanders, however, is obviously not a result of the force reductions. The lieutenants that would

PROJECTED INVENTORY*
By Grade (1990-1995)

Number of officers

Fiscal Year	ENS	LTJG	LT	LCDR	CDR	CAPT
1990	137	273	1184	588	329	154
1991	56	334	1160	590	305	142
1992	53	247	1165	605	296	142
1993	45	171	1138	671	272	134
1994	54	164	1042	657	303	138
1995	50	163	962	678	282	153

Legend: 1990, 1991, 1992, 1993, 1994, 1995
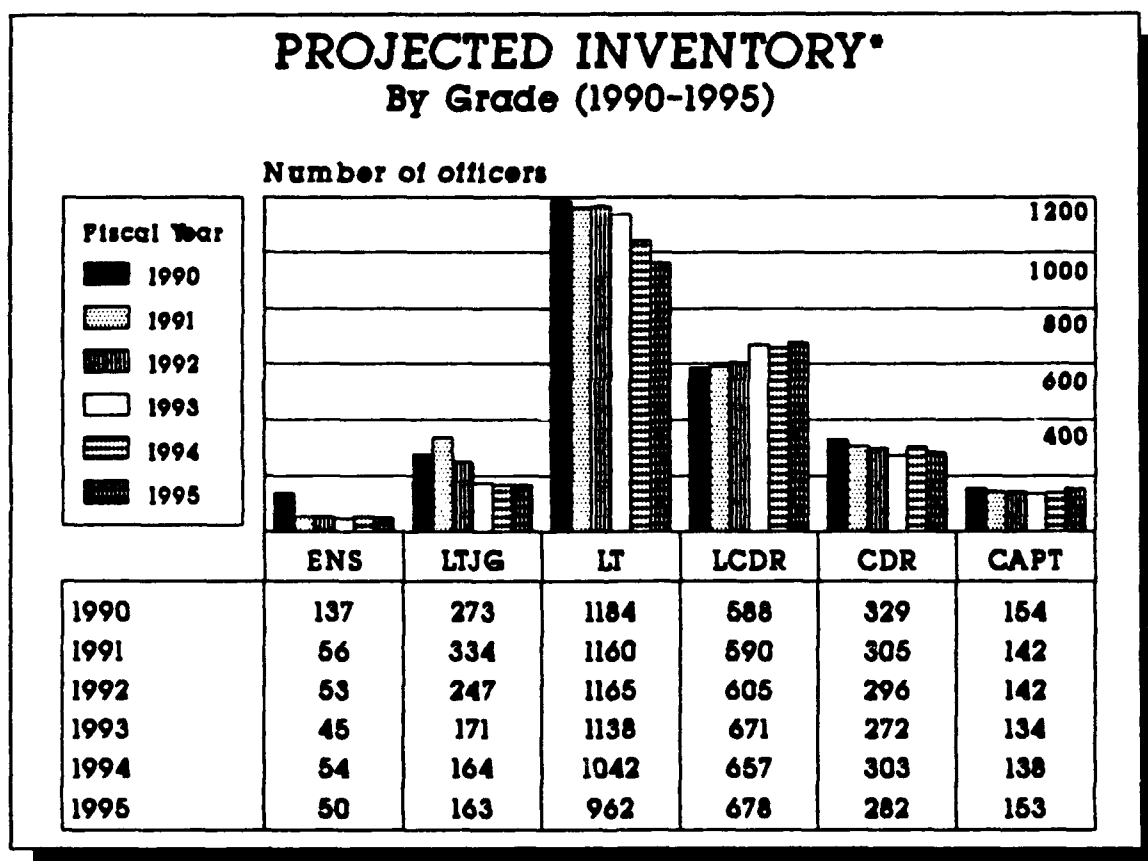
* Begining Inventory

Figure 4.2 Aggregate MSC Inventory by Grade Projected for 1990 through 1995

be promoted to lieutenant commander were already in the inventory prior to the period of force reductions. This build up of the lieutenant commander inventory will develop if the

53

actual promotion rate to lieutenant commander and the actual continuation rates will be consistent with those used in these forecasts.

This increasing inventory of lieutenant commanders, if allowed to develop, may create a promotion problem totally unrelated to the force reductions. Inventories of over 600 lieutenant commanders may be well above the ROPA for these years and carry-downs (explained in Chapter 2, Section A and Table 2.3), may not be sufficient to absorb these increases.

Because the lieutenants already exist in the inventory, the most obvious method of preventing this sharp increase in the lieutenant commander inventory would be to slow the promotion of lieutenants to lieutenant commander during the years FY 1992 through 1995. Slowing the promotions would mean that the flow point to lieutenant commander from 1992 through 1995 would gradually increase from ten to 11 years of service as fewer lieutenant commander vacancies would be made available and therefore, fewer officers placed in the promotion zone. The flow point to lieutenant commander may remain at 11 years of service until the mid 1990's.

By the year 2000, holding accessions, continuation rates, and promotion rates constant, the total inventories of ensigns, lieutenants junior grade, and lieutenant begins to stabilize. The total inventories of lieutenant commanders and captains begins to decrease slightly and the total number of

commanders increases slightly. Figure 4.3 illustrates these projections to the year 2000.

As a percent of the total force structure, the major shift is seen in the lieutenant commander inventory. In 1989,

PROJECTED INVENTORY*
By Grade (1995-2000)

Number of officers

Fiscal Year	ENS	LTJG	LT	LCDR	CDR	CAPT
1995	50	163	962	678	282	153
1996	73	191	921	675	277	148
1997	84	225	884	679	296	120
1998	78	253	907	632	304	114
1999	71	248	909	625	311	124
2000	74	238	917	607	331	121
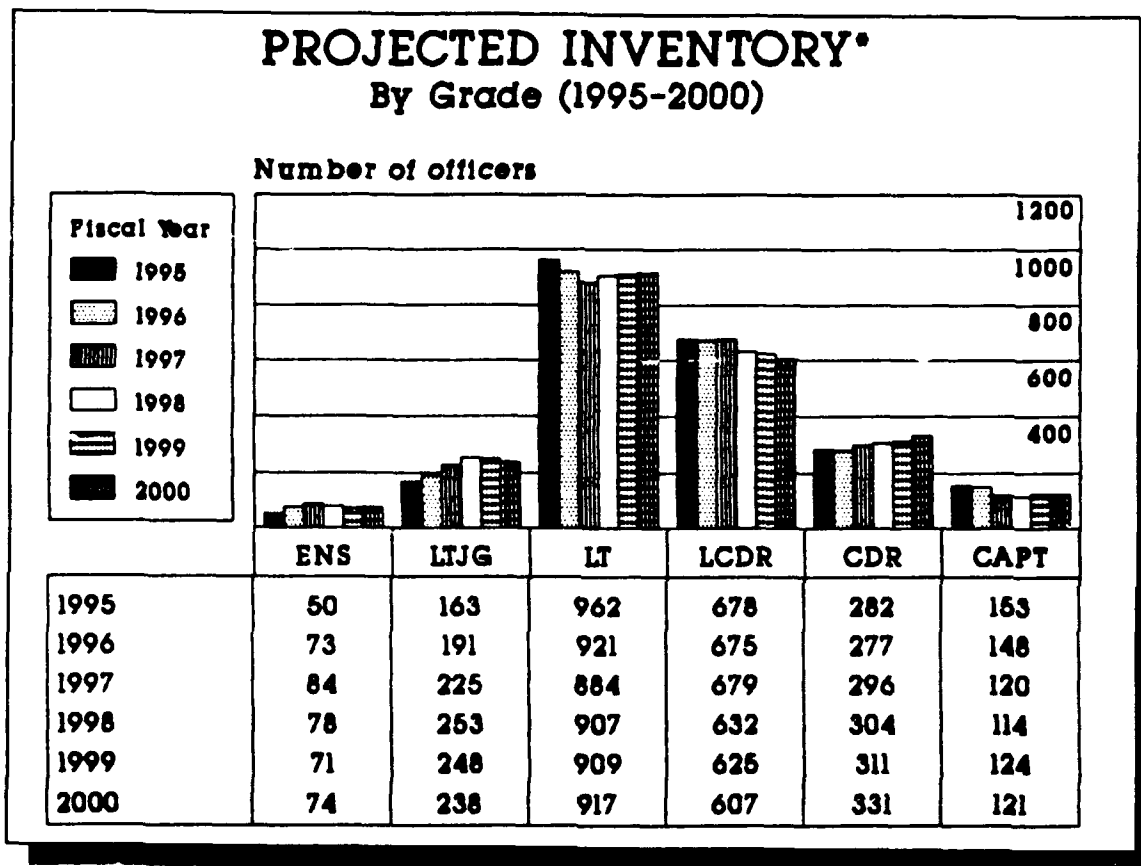
* Beginning Inventory

Figure 4.3 Aggregate MSC Inventory by Grade Projected for 1995 through 2000

lieutenant commanders comprised about 23 percent of the MSC force. Based on the forecast displayed in Figure 4.2 and Figure 4.3, this proportion jumped to 30 percent by FY 1995 and fell back slightly to 27 percent by the year 2000. The lieutenants, however, who made up 43 percent of the force in

FY 1989 dropped to 42 percent in 1995 and 40 percent in the FY 2000. The percent of the force in the three junior grades changes from 58 percent in FY 1989, to 51 percent in FY 1995 and returns to only 53 percent by the year 2000. Table 4.9 displays the proportions of the total MSC strength for each of the six grades in fiscal years 1989, 1995 and 2000.

TABLE 4.9 PERCENT OF THE MSC FORCE ACROSS GRADES

FISCAL YEAR	ENS	LTJG	LT	LCDR	CDR	CAPT
1989	4	11	43	23	13	6
1995	2	7	42	30	12	7
2000	3	10	40	27	15	5

For the policy makers, these results depict a more senior force by 1995 and beyond, and therefore a more expensive force than that of the early 1990's.

This chapter provided a bases for establishing the critical parameters used to forecast future inventories following a five year period of reduced accessions. The inventories during this reduction period were then moved forward another ten years using the "FORCE" model. The effects of the accession deficits on the promotion flow points to lieutenant commander and commander were examined and their effect on the projected inventories were discussed.

V. TESTING THE FORCE REDUCTION SCENARIO
WITH HCA DATA

A. ESTABLISHING THE PARAMETERS

1. Beginning Inventory

The fiscal year 1990 beginning inventory of HCA officers was constructed using the data available from the FY 1989 data file. As discussed in Appendix A, Section 3, subspecialty code changes that are a result of a move between the HCA and HS subcommunities must be considered as accessions to, and losses, from the respective subcommunities in order to maintain accurate accounting. Because the FY 1990 BUMIS data was not available at the time of this analysis, the number of MSC officers who switched from one subcommunity to the other during FY 1989 could not be determined. As such, the projected FY 1990 HCA inventory used as the basis for this portion of the analysis may not reflect the actual number of officers that would be found in the FY 1990 BUMIS data file.

Although it is difficult to project how many officers switched subcommunities during 1989, the number was probably less than 25 officers. In FY 1985, five officers changed subcommunities, in FY's 1986, 1987 and 1988, there were 22, 12 and 11 such officers respectively.

2. Continuation and Promotion Rates

The continuation rates and promotion rates were determined the same way as those used in the MSC scenario. These rates are displayed in Appendix E.

3. Accession Proportions

Similar to the analysis with the aggregate data, the actual number of HCA accessions will be set to meet the beginning inventory targets. The average accession proportions computed from the FY 1985 through 1989 accessions are displayed in Table 5.1 for the appropriate grade and years of service combinations.

TABLE 5.1 AVERAGE HCA ACCESSION DISTRIBUTION FROM 1985 THROUGH 1989.

GRADE	YEARS OF SERVICE	AVERAGE PROPORTION
1	1	.557
1	2	.004
2	1	.009
2	2	.080
2	3	.245
2	4	.006
3	4	.071
3	5	.010
3	6	.013
3	7	.002
3	8	.003
	TOTAL %	1.00

In order to determine the number of HCA officers to access between FY 1990 and 1995, we must first determine what percent of the accessions have historically been HCA officers.

Table 5.2 displays the breakdown of the accessions between the HCA and HS communities from 1985 through 1989.

TABLE 5.2   COMPARISON OF HCA AND HS ACCESSION PERCENTAGE FROM 1985 THROUGH 1989.

FISCAL YEAR	HCA PERCENTAGE	HS PERCENTAGE
1985	46	54
1986	45	55
1987	49	51
1988	54	46
1989	30	70
Average Accession Percentage	43.4	56.6

B.   RESULTS OF THE HCA SCENARIO

The HCA scenario is to forecast force structures assuming a three percent reduction in end strength per year for each of five consecutive years. The reductions will be accomplished entirely by cuts in accessions, primarily cuts from the HCA community.

The beginning strength targets established in Table 4.3 for the entire MSC community will remain in effect during this phase of the analysis as well. Therefore, the projected number of MSC accessions for the FY's 1990 through 1995 will also remain the same as those given in Table 4.5. Table 5.3

59

shows the number of the HCA and HS officers that would be accessed if the historical **average** **accession** **percentages** of 43.4 and 56.6 , were applied to these projected accession numbers.

TABLE 5.3   BREAKDOWN OF HCA AND HS OFFICER ACCESSIONS TO MEET THE BEGINNING INVENTORY TARGETS IN TABLE 4.3 WHEN APPLYING AVERAGE ACCESSION PERCENTAGES

ACCESSION YEAR	MSC ACCESSIONS	HCA OFFICERS ACCESSED	HS OFFICERS ACCESSED	MSC TARGET FOR THE FOLLOWING FISCAL YEAR
1990	145	63	82	2,585
1991	140	61	79	2,507
1992	120	52	68	2,432
1993	145	63	82	2,359
1994	130	56	74	2,288

However, the HCA scenario suggests that the normal accession percentages are not going to be applied during this period of reduction. If the Medical Service Corps is faced with reductions, the majority of these cuts will probably be taken from the HCA community. This assumption is based on the premise that administrative services could be contracted from civilian sources. Although many of the HS services also could be contracted, contracts for such health services tend to be more expensive and harder to negotiate because they involve issues of quality-of-care and health care standards.

Based on this assumption, the percent of HCA accessions projected for FY's 1990 through 1995 was reduced from the historical average of 43.4 percent to just 30 percent. The

60

model was then used to project the HCA inventories for FY's
1991 through 1995 using HCA accessions as shown in Table 5.4

TABLE 5.4   BREAKDOWN OF HCA AND HS OFFICER ACCESSIONS BY
APPLYING A 30 PERCENT RATE FOR HCA OFFICERS

ACCESSION YEAR	MSC ACCESSIONS	HCA OFFICERS ACCESSED	HS OFFICERS ACCESSED	PROJECTED HCA SHARE OF NEXT FY TARGET
1990	145	44	101	1,300
1991	140	42	98	1,238
1992	120	36	84	1,185
1993	145	44	101	1,132
1994	130	39	91	1,069

The distributions of the HCA accessions across the
grade/YOS combination for each of the fiscal years 1990
through 1994 can be determined by multiplying the accession
proportions from Table 5.1 by each of the HCA accessions
listed in Table 5.4 above.

As with the MSC scenario, after projecting the inventories
through the five years of reductions, the force strength was
held constant at the 1995 beginning inventory level of 2,288.
Again, the gap in the force structure created by five years of
reduced accessions would not affect the flow point to the
control grades for several years.   Thus, forecasting of
inventories was continued for an additional ten years.

As in the MSC scenario, the accessions following 1995 were
increased to maintain the force at 2,288 officers.   (See Table
4.7 for the required accessions)   The accession percentage for

HCA officers was reset from 30 percent, used during the reduction period, to the historical average of 43.4 percent for all projections after fiscal year 1995. Table 5.5 displays the projected inventory of HCA lieutenants with four to twelve years of service for FY's 1995 through 2004.

TABLE 5.5 PROJECTED INVENTORY OF HCA LIEUTENANTS FROM 1985 THROUGH 2004 WITH 4 THROUGH 12 YEARS OF SERVICE

YEARS OF SERVICE

	4	5	6	7	8	9	10	11	12
FY									
1985*	94	68	62	43	87	24	5	0	2
1986*	72	97	64	62	42	60	6	0	0
1987*	120	84	94	60	62	42	37	4	0
1988*	79	124	81	92	59	61	39	11	1
1989*	68	94	120	82	87	56	53	10	7
1990	122	71	86	115	79	82	36	13	9
1991	42	123	66	83	109	74	81	5	10
1992	89	43	114	63	79	102	73	12	4
1993	79	89	41	109	60	74	100	11	9
1994	36	79	83	39	103	56	73	15	8
1995	36	36	74	80	37	97	55	11	11
1996	37	37	34	71	76	35	95	8	8
1997	52	38	35	33	67	71	34	14	6
1998	53	53	36	34	31	63	70	5	11
1999	78	54	50	35	32	29	62	10	4
2000	77	79	51	48	33	30	29	9	8
2001	75	78	74	49	46	31	29	4	7
2002	72	76	73	71	46	43	30	4	3
2003	74	73	71	70	67	43	42	4	3
2004	74	75	68	68	65	63	42	6	3

* Represents actual data from the BUMIS data file. All other data are projected inventories

62

The first diagonal set of shaded blocks represents the 1987 HCA accessions as they reach the eighth, ninth and tenth years of service. The next five diagonal sets of shaded blocks represent the HCA accessions for fiscal years 1990 through 1994 as they reach the eighth, ninth and tenth years of service.

Similar to the findings with the aggregate data, the number of officers between fiscal years 2000 and 2004 at ten years of service may be too small to create an adequate promotion zone and the flow point to lieutenant commander may have to be shifted back to nine years of service during this period.

Unlike the MSC scenario, where there were only three years of smaller inventories, the HCA community does not recover immediately. The negative impact on projected inventories is much more severe for the HCA community because they absorbed the major portion of the three percent force reductions in this HCA scenario.

If we look forward by projecting inventories for another five years, the deficits in the HCA inventory that were created by the five years of reduced accessions, will have reached the flow point for commander. As in Chapter 4, the projected inventories for fiscal years 2004 through 2009 were created by holding the continuation rates and promotion rates steady. Table 5.6 displays the results of the lieutenant commander inventories forecasted to the year 2009.

The first set of diagonally shaded cells represent the 1987 accessions as they reach the 14th, 15th and 16th years of service. The next five sets of diagonally shaded cells represent the fiscal years 1990 through 1994 accessions as they reach the commander promotion zone.

As evidenced in the MSC scenario, the inventory at 16 years of service in the fiscal years 2003, and 2006 through 2009, are lower than the inventory of officers at any previous commander flow point. If the number of commander vacancies remains the same as that of 1985 through 1989, there is serious doubt that enough HCA officers will exist in the inventory during the fiscal years 2006 to 2009 to provide an adequate size zone for promotion to commander.

However, in both cases of promotion to lieutenant commander and commander, the decision to contract administrative services may have a opposite effect on the force structure. If senior executive positions are contracted, there will be fewer requirements and thus fewer vacancies for lieutenant commanders and commanders. Fewer vacancies equate to necessarily smaller promotion zones, and therefore, these smaller inventories may not present a problem.

TABLE 5.6 PROJECTED INVENTORY OF HCA LIEUTENANT COMMANDERS FROM 1985 THROUGH 2009 WITH 11 THROUGH 17 YEARS OF SERVICE

YEARS OF SERVICE

	11	12	13	14	15	16	17
FY							
1985*	40	114	54	20	5	2	0
1986*	48	39	102	39	8	3	2
1987*	38	45	38	97	14	6	3
1988*	70	36	40	37	52	12	6
1989*	33	69	35	36	36	31	10
1990	46	33	62	33	30	8	16
1991	48	46	30	57	30	28	1
1992	65	48	43	28	52	7	22
1993	58	64	44	40	26	48	1
1994	80	57	59	40	37	24	4
1995	58	79	53	54	37	34	2
1996	44	57	73	49	50	34	3
1997	76	44	53	67	45	46	3
1998	27	75	41	49	61	41	4
1999	56	27	69	38	45	56	4
2000	50	55	25	63	35	41	5
2001	23	50	51	23	58	32	4
2002	23	23	46	47	21	53	3
2003	24	23	21	42	43	19	5
2004	34	24	21	19	39	40	2
2005	34	34	22	19	17	36	4
2006	50	34	31	20	17	16	3
2007	49	50	31	20	18	16	1
2008	47	49	46	20	27	17	1
2009	46	47	45	42	27	25	2

* Represents actual data from the BUMIS data file. All other data are projected inventories

65

C. FORCE REDUCTION EFFECTS ON HCA INVENTORIES

As in the MSC scenario, a look at the total number of officers in the inventory, irrespective of their years of service may tell another story. Figure 5.1 provides a representation of six years of total inventories for the six grades.

As with the aggregate data represented in Figure 4.1, we see a substantial increase in the number of HCA lieutenants. Unlike the aggregate data, we also see a gradual decline in the number of lieutenant commanders and an increase in the number of commanders. (Changes in Figure 5.1 may appear more pronounced than those in Figure 4.1 due to changes in the scale of the Y-axis). Similar to the aggregate data, the captain inventory gradually increased, the lieutenant junior grade inventory remained fairly constant, while the ensign inventory fluctuated greatly.

The next diagram, Figure 5.2, displays the projected HCA inventories during the period of reduction from fiscal years 1990 through 1995. Again, we see the decline in total ensign, lieutenant junior grade and lieutenant inventories and the sharp increase in total lieutenant commander inventory. The total commander inventory begins to decline, while the total captain inventory remains relatively constant during this period of reductions. Figure 5.3 illustrates the projections to the year 2000.

HCA INVENTORY *
By Grade

Number of officers

Fiscal Year		ENS	LTJG	LT	LCDR	CDR	CAPT
1985		41	168	386	307	137	52
1986		47	181	404	308	125	66
1987		87	154	503	294	139	75
1988		22	183	548	262	159	86
1989		79	171	577	270	153	94
1990		76	140	616	262	175	86
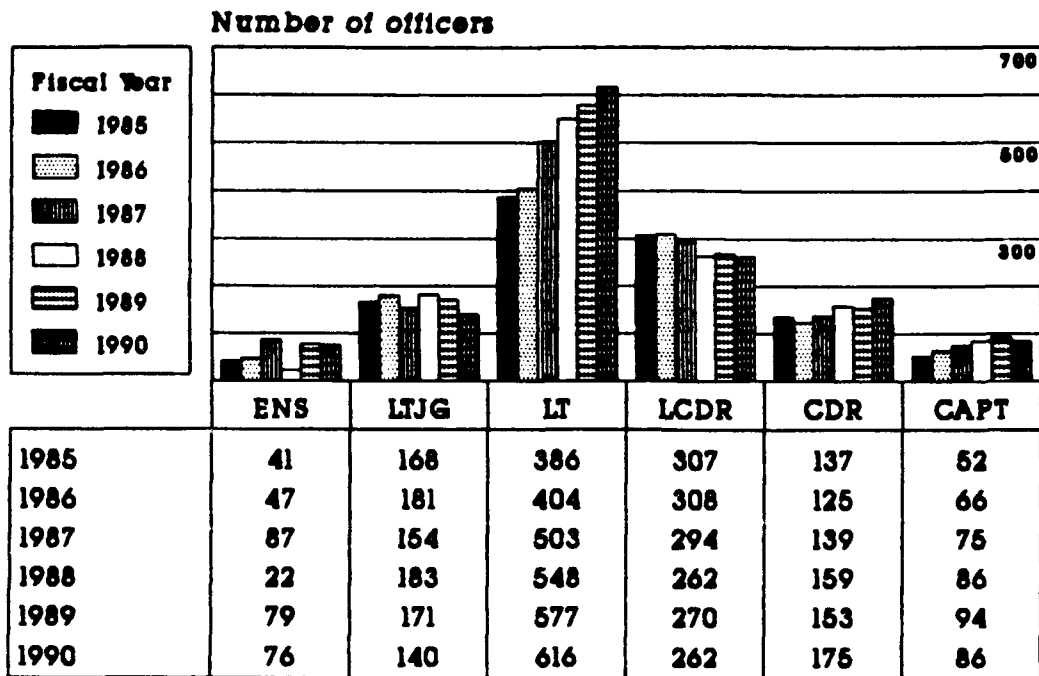
* Beginning Inventory

Figure 5.1 HCA Inventory by Grade from 1985 through 1990

(1990 is projected inventory)

By the year 2000, holding the continuation rates and
promotion rates constant, the total inventory of lieutenants
and lieutenant commanders both begin to stabilize. The total
lieutenant junior grade inventory gradually returns to pre-
reduction strength while the total lieutenant commander and
captain inventories begin to decline.

As a percentage of the HCA community, the lieutenant and
lieutenant commander inventories experience the greatest
shifts. In 1989, lieutenants made up 43 percent of the HCA
community, lieutenant commanders were 20 percent of the

HCA PROJECTED INVENTORY *
By Grade (1990-1995)

Number of officers

Fiscal Year						
■ 1990						
▨ 1991						
▨ 1992						
☐ 1993						
▤ 1994						
■ 1995						

	ENS	LTJG	LT	LCDR	CDR	CAPT
1990	76	140	612	262	176	66
1991	27	176	696	263	167	81
1992	24	116	683	284	166	76
1993	21	69	673	313	141	68
1994	26	64	494	325	153	70
1995	23	63	439	333	129	82
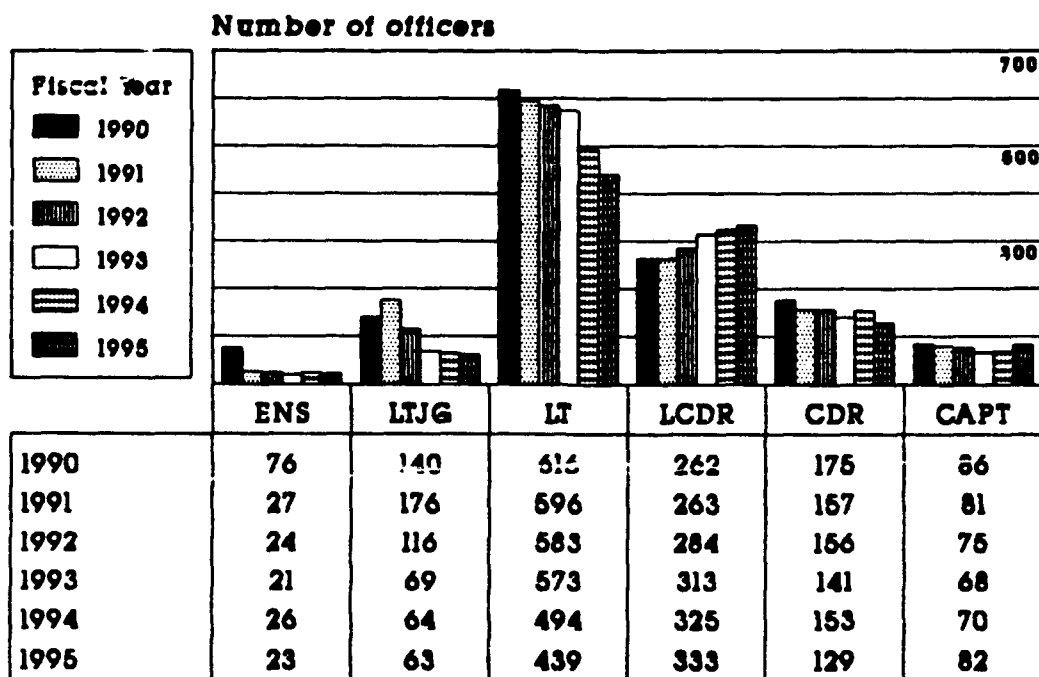
* Beginning Inventory

Figure 5.2 HCA Inventory by Grade Projected from 1990 through 1995

community. By the year 2000, lieutenants drop to only 36 percent of the HCA force while lieutenant commanders increase to 31 percent in 1995 and return to only 27 percent by the year 2000. Table 5.7 displays the percentage of the HCA community in each of the six grades in the fiscal years 1989, 1995 and 2000.

If the HCA community absorbs the major portion of the force reduction, the overall composition of the MSC force will also change by the year 2000. In 1989, 53 percent of the lieutenant MSC officers were administrators (HCA), by the year

HCA PROJECTED INVENTORY *
By Grade (1995-2000)

Number of officers

Fiscal Year						
■ 1995						
▒ 1996						
▓ 1997						
☐ 1998						
≡ 1999						
▓ 2000						

	ENS	LTJG	LT	LCDR	CDR	CAPT
1995	23	63	439	333	129	82
1996	51	82	404	326	124	82
1997	53	114	352	341	138	67
1998	51	142	358	306	144	59
1999	46	139	357	304	129	59
2000	48	134	365	283	134	56
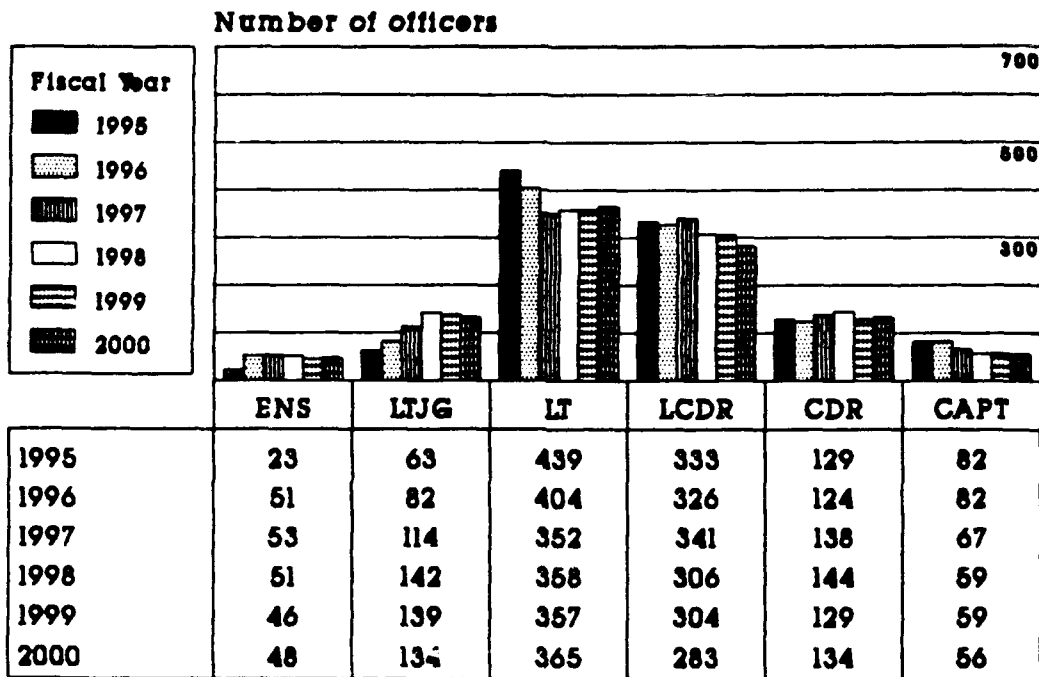
* Beginning Inventory

Figure 5.3 HCA Inventory by Grade Projected from 1995 through 2000

2000, only 41 percent of the MSC lieutenants are HCA officers. The HCA officers made up 64 percent of the captains in 1989, but this percent falls to only 46 percent by the year 2000. Table 5.8 displays the HCA and HS officer percentages of each grade for fiscal years 1989, 1995 and the year 2000.

69

TABLE 5.7 PERCENT OF THE HCA COMMUNITY ACROSS GRADES

FISCAL YEAR	ENS	LTJG	LT	LCDR	CDR	CAPT
1989	6	13	43	20	11	7
1995	2	6	41	31	12	8
2000	5	13	36	28	13	5

TABLE 5.8 PERCENT OF THE HCA AND HS OFFICERS IN THE MSC FORCE ACROSS GRADES

FISCAL YEAR	ENS	LTJG	LT	LCDR	CDR	CAPT
	HCA/HS	HCA/HS	HCA/HS	HCA/HS	HCA/HS	HCA/HS
1989	69/31	64/36	53/47	47/53	48/52	64/36
1995	46/54	39/61	46/54	49/51	46/54	54/46
2000	65/35	56/44	40/60	47/53	40/60	46/54

This chapter tested the impact of a force reduction on the HCA subcommunity. The accession percentage for the HCA and HS subcommunities was examined and the parameters for testing a five year force reduction on HCA data were established assuming that the bulk of the reduction will be suffered by the HCA community.

Similar to the analysis in Chapter 4, the accession deficit created during the reduction period was moved forward an additional ten years using the "FORCE" model. The effects of these deficits on the promotion flow point to lieutenant commander and commander were examined and the projected inventories presented.

VI. SUMMARY

A. CONCLUSIONS

1. Conclusions: MSC Scenario.

The MSC scenario tested a three percent reduction each year for five consecutive years using the MSC data from fiscal years 1985 through 1989. The decision to test a three precent reduction was arbitrary, as the intent of the analysis was to demonstrate a method of testing the effects of such a policy decision. The results of this test revealed that:

- Accomplishing a three percent reduction for five years entirely by decreasing accessions will create gaps in future inventories. These gaps may present a problem by the year 2000 if the intention is to keep the lieutenant commander flow point at 10 years of service. The analysis demonstrated a projected decline of officers at the flow point for promotion to lieutenant commander and this suggests that the flow point may have to be shifted back toward nine years of service in the years 2000, 2001 and 2002. If the number of selectees per year is to remain constant, a shift backward to include earlier year groups would be necessary to keep the number of officers in the zone constant during these lean years.

- The commander flow point at 16 years of service may also be affected by the year 2006. The analysis

71

demonstrated a projected decline of officers at the commander flow point. This decline suggests that this flow point may have to be shifted back toward fifteen years of service for commander selectees in the years 2006, 2007 and 2008.

- From 1995 and beyond there may be a shortage of junior officers in the inventory. The percent of the force in the three junior grades changes from 58 percent in 1989, to 51 percent in 1995 and returns to only 53 percent by the year 2000. Commensurate reductions in lieutenant commanders, commanders and captains during the reduction period may help to prevent a force structure imbalance from developing.

- A notable finding unrelated to the force reductions is the potential growth in the lieutenant commander inventory. Because the lieutenants, who would be promoted to lieutenant commander already exist in the inventory prior to the period of reductions, the most obvious method of preventing a sharp increase in the lieutenant commander inventory would be to slow the promotions of lieutenants during the period 1991 through 1995. Slowing the promotions, however, may result in a promotion "choke point" to the lieutenant commander level.

If a choke point develops at the flow point to lieutenant commander, the attrition rate for young lieutenants may increase. The MSC community may find itself faced with

some of the same promotion and attrition problems currently associated with the Nurse Corps. [Ref. 6]

2. **Conclusions: HCA Scenario.**

The accession percentage tested in this scenario was based on a <u>critical assumption</u> that the HCA community would absorb the major portion of the force reductions. Actual force reduction may be much smaller than those tested in this analysis, and the actual percent of those reductions earmarked for the HCA subcommunity may not be as severe as those tested in the HCA scenario. The HCA scenario as tested shows that:

• There may be severe shortages of HCA officers at the lieutenant commander flow point beginning in the year 2000. The results suggest that combining two year groups together, i.e. officers with nine and ten years of service, still may not provide a sufficient number of officers for a promotion zone. Shortages in the lieutenant inventory at nine and ten years of service may exist in fiscal years 2000 through 2004.

Unlike the MSC scenario, where there were only three years of smaller inventories, the HCA community does not recover immediately. The negative impact on projected inventories is much more severe for the HCA community because they absorbed the major portion of the three percent force reductions in this scenario.

• The analysis suggest that the similar shortages may develop at the commander flow point of 16 years of

73

service.   If the number of commander vacancies remains consistent with that of the period 1985 through 1989, there is serious doubt that enough HCA officers will exist in inventory at 16 years of service during the fiscal years 2006 to 2009 to provide an adequate size zone for promotion to commander.

• In both cases of promotion to lieutenant commander and commander, the decision to contract administrative services may have an opposite effect on the force structure. If senior executive positions are contracted, there will be fewer requirements and thus fewer vacancies for lieutenant commanders and commanders.   Fewer vacancies necessitate smaller promotion zones, and therefore, these smaller inventories may not present a problem.

3. **General Conclusions.**

This thesis made use of the interactive, PC based, software model, "FORCE", to analyze the force structure of the Medical Service Corps. Working with current data and updated estimates of continuation rates, promotion rates and planned accessions, this thesis demonstrated how planners may adjust these parameters and variables to forecast future inventories testing the effect of proposed policies on the future force structures.

The results of the two scenarios tested are highly dependent upon the variables and parameters selected to project future inventories. Of course, any forecast beyond two or three years must always be interpreted with caution.

Here, the inventory forecasts to the year 2009 provide only a hypothetical representation of the future force structures.

If a three percent force reduction is imposed, this analysis does reveal some possible areas of concern in the force structure that should be monitored over the next several years. To a large extent, this analysis tested a worse case scenario, since actual reductions are likely to be less severe.

The analysis suggests that the percentage of the MSC force in the three senior grades is increasing. In 1989, this figure was 42 percent, by 1995, this may grow to 49 percent of the force. If a decision is made to contract senior executive administrative services, this might reduce the need for senior MSC officers at a time when the force is moving to a higher percentage of senior officers.

This analysis did not address the effects of the force reductions on the Health Science subcommunity. This is not to imply that this portion of the MSC community will be untouched by a reduction in force. However, using the accessions and end strength targets tested in the HCA scenario, the total inventory of HS officers will decrease from 1,310 in 1990 to 1,219 by 1995. This represents a real reduction of only seven percent. In comparison, the HCA sub-community decreases from 1,355 to 1,069, a real loss of 21 percent.

B. RECOMMENDATIONS

1. The fiscal year 1990 data should be processed and a file developed for use with the model. Adding one more year of actual data will render future projections more reliable.

2. Additional scenarios might be tested which examine alternative ways of force reductions. These alternatives might include methods of reducing some senior officer grades in conjunction with some cuts in accessions. Senior officer grades might be reduced by convening Selective Early Retirement boards or setting strict quotas for the Continuation boards. Officers who twice failed of selection for the next grade could be released instead of granting them continuation.

3. An examination of the billet structure is appropriate. Any reduction in inventory must be accompanied by cuts in requirements. The "Force" model can project inventories by grade and YOS, but this provides only one half of the manpower puzzle. Matching these inventory projections to billet requirements may help determine whether cuts should be made in senior or junior officer strengths, in health care administrators, or health science officers.

4. Military end strength is being reduced during a time of escalating requirements for medical services and facilities. Any cuts in allied health providers will most certainly be matched by increased costs in the Civilian Health and Medical Program for the Uniformed Services (CHAMPUS) or

76

alternate health care programs. Therefore, it is reasonable to assume that military strength cuts would be taken in administration. A cost-benefit study should be conducted to confirm this assumption and to quantify the potential savings against the benefits lost.

5. Recommendations for future research in this area:

The continuation rates or the actual number of losses during each fiscal year are critical to determining the next year's recruitment goals and promotion vacancies. Developing a behavioral model to study the factors that affect the retention of Medical Service Corps personnel may help the manpower planners determine who might stay or leave the service. The losses projected by such a behavioral model could serve as input to the "FORCE" model. More accurate loss projections most certainly would produce more accurate inventory projections.

This analysis attempted to demonstrate the flexibility of this force structure model to forecast inventories and monitor the effect of policy decisions on future inventories. Alternative scenarios to those tested in this thesis are very probable. The "FORCE" model will provide the manpower planner with a tool to analyze these alternatives.

APPENDIX A

THE MEDICAL SERVICE CORPS DATA

1. General Information.

The data was processed by SAS, Version 5.18G, a software system for data analysis. This appendix contains detailed information on how the data were merged and modified to correct missing year groups. Because the five years of data were merged, each individual's record contained five fields to convey each data component. For instance, one person would have the fields, GRADE85, GRADE86, GRADE87, GRADE88, and GRADE89. Labeling the data from each of the five files in this manner allows for a longitudinal review of the individual's record. Fields such as year group, active commission base date, or source of commission remain constant over time. Data components such as these exist only once in the merged dataset.

2. Inventories.

The data tapes received from the Medical Data Service Center provided a record of officers on active duty at the end of the fiscal year. Under most circumstances, the end of one fiscal year data, say 1985, should be the same as the beginning inventory data for 1986. Unfortunately, with the coding error discovered in the file, this could not be automatically assumed. Several steps were taken to recreate

the actual beginning inventories for each of the five fiscal years of data.

To convert these ending inventories into beginning inventories three tasks had to be accomplished. One, the records of those officers who did not exist at the beginning of the year were removed. Two, the current year losses had to be counted, because they did exist at the beginning of the year. And finally, all losses prior to the current year also had to be removed.

A series of commands were used to accomplish these tasks. First, all records marked as deleted prior to year under review were removed. A record is marked as deleted when the delete code (DELCD) field contains a "1". Thus, if the DELCD was equal to one and the estimated loss date (ELD) was prior to the year for which the inventory is being constructed, the record was deleted.

The DELCD field contains the number "2" when the record is marked as a prospective gain. A combinations of both the DELCD field and the report date (RPD) were used to determine if the record was an accession. For example, if we are computing the 1985 beginning year inventories, we must remove the accession for 1985. The following code was used to remove these accessions:

```
1) IF DELCD84='2' AND (RPD84 GE 8410 AND RPD84 LE 8509) THEN DELETE;
2) IF DELCD84='2' AND RPD84=' ' THEN DELETE;
3) IF DELCD85='2' AND RPD85 GT 8509 THEN DELETE;
4) IF (RPD85 GE 8410 AND RPD85 LE 8509) AND (YEAR85='1' AND YEAR84 NE '1') THEN DELETE;
```

The first line of code deletes any record with a report date in fiscal year 1985 that was marked as a prospective gain in 1984. The second line removes any record that was a prospective gain in 1984 but failed to report in 1984. The next line removes those records marked as prospective gains in 1985 with report dates after 1985, and the last line removes only those record with a 1985 report date that did not exist in 1984. This last line prevents removing records with a 1985 report date that may actually represent a report date for a second or subsequent tour, not an accession.

Inventories were also computed for the health care administration and health science subcommunities. Once the aggregate inventory was established, the data set was modified into the two subsets using subspecialty codes. A complete list of the codes used is available in Appendix D.

3. **Accessions.**

Several problems were encountered trying to compute the accessions. The fact that a record contained a report date (RPD) in the year under review does not mean that the record represented an accession. To rectify this problem, the same method used to remove accessions above was used here to count the accessions.

The practice of placing prospective gains in the data file resulted in many invalid and incomplete records.[1] These gains could not be collectively added as accessions because not all the records appeared in the next year's inventory. Likewise, these records could not be arbitarily deleted either. If all records containing DELCD84='2' were deleted, those who actully reported as new accessions in 1985 would be absent from the dataset. Therefore, continuing with the example of 1985 accessions, a record was counted if it met three criteria: (1) the report date was in 1985, (2) the record did exist in the 1985 file, and (3) the record did not exist in 1984 unless it was marked as a prospective gain.

Accessions in 1985 are actually part of the 1986 beginning inventory. This presented another problem in computing the accessions if the officer was selected for promotion in the same year he was accessed. Also, because of constructive credit, some ensign accessions are actually lieutenant junior grade (LTJG) by the beginning of next year.

To determine which ensigns would be promoted to LTJG by the next year, their 1985 record was matched to the 1986 record. If the GRADE86 field revealed a LTJG code, this ensign accession was counted as a LTJG accession.

_____

[1]The problems encountered with the prospective gains may have been avoided by deleting them prior to merging the five years of data into one file. Once the file was merged, however, deleting any record that was coded as a gain in any year would remove that officers record entirely from the dataset.

Likewise, if a 1985 accession was considered by the fiscal year 1986 selection boards (those boards held in 1985), and selected for promotion to lieutenant (LT), the officer was recorded as a LT accession. The one problem with this method is the fact that not all persons selected for promotion in 1985 will actually be promoted by the beginning of 1986. By accessing these individuals at their promoted rank, the projection of officers for the next fiscal year will be biased upward. As these officers are actually promoted to the next rank, and the dataset is updated, the projections will be balanced with the true inventory.

In the working definitions, accession was defined as a new entrant into the system. When considering one of the subcommunities as the system, changes in subspecialty must be recorded as accessions (and losses) to the respective communities. For instance, if a commander is a pharmacist in 1985, and gets redesignated as a health care administrator, he must be recorded as a loss to the HS subcommunity and an accession to the HCA subcommunity.

The following line of code was used to determine which officers changed their subspecialty from one year to the next:

```
IF SUBSTR(SUBSP188,1,4) NE SUBSTR(SUBSP189,1,4) AND (YEAR88='1' AND YEAR89='1');
```

This code compared the first four digits of the subspecialty code field on only those records that existed in both years. Thus, if the officer was a new accession, he was not double

82

counted. Each of these changes (gains/losses) were added manually to four of the HCA and HS data sets provided with the model. Subspecialty changes were not added to the 1989 files, because 1990 data were not available for comparison.

Computing the accessions for 1989 had one additional consideration, the physician assistants (PAs). The Deputy Chief of Naval Operations for Manpower, Personnel and Training (DCNO (MP&T)) conducted a voluntary conversion program to convert qualified PAs from warrant officer to commissioned officers. Chief warrant officers in grades CWO-2 through CWO-4 were commissioned as ensigns to lieutenants under this conversion program. The grade upon appointment was determined based on the current grade and date of rank. [Ref. 12]

The data obtained from the Medical Data Service Center did not contain the year group for 91 percent of those PAs commissioned. Appendix B, part II, explains the algorithm used to compute these missing year groups. This data was then merged with the MSC file to determine the total number of accessions for 1989.

4. Losses.

Computing losses was very straight forward. The DELCD field and the ELD fields were used. If the record was marked as deleted, and the loss date fell in the fiscal year under review, the record was counted as a loss.

One coding error was discovered in the 1985 data when losses were computed. Approximately 15 records had the

83

DELCD85 empty, signifying that the officer was still on active duty at the end of 1985. But, matching the records longitudinally revealed that the DELCD86 was marked as "1", and the ELD was actually in fiscal year 1985.

The following code was used to check the status of the DELCD one year in advance:

```
IF (DELCD85-'1' AND (ELD85 GE 8410 AND ELD85 LE 8509)) OR (DELCD86-'1' AND (ELD86 GE 8410
AND ELD86 LE 8509))
```

If the next years record was marked as deleted and the ELD was in the fiscal year under review, it was counted as the loss.

5. **Promotions.**

No major problems were encountered while compiling the promotion data. The initial code that established the beginning of year inventory was used. The number of persons selected for promotion was extracted by searching the PROM field. This field contained an 'S' for selectee and the last digit of the fiscal year the promotion would be effective. For instance, the promotion boards held in 1985 were for promotion in fiscal year 1986. The PROM85 field would contain 'S6' if the officer was selected for promotion.

As explained in the accession information above, officers who were accessed and selected for promotion in the same year, were accessed at the higher grade. This was necessary because the model promotes only from beginning year inventories. However, this practice of accessing officers at the higher grade results in biased promotion rates for lieutenant junior grade and lieutenant.

For example, if the beginning inventory of lieutenant junior grade officers is 100, and 80 of these officers are selected for promotion, the promotion rate would be 80/100 or 80 percent. But, if there are an additional 10 lieutenant junior grade officers who were accessed and also selected for promotion within that same year, the actual number of selectees for promotion as shown in the data file is really 90, not 80. If we were to add these officers to the inventory, we would have 90/110, for a promotion rate of 81 percent.

However, the procedure of accessing selectees at their promoted or higher rank and accepting the downward bias in the promotion rate to lieutenant junior grade and lieutenant must be preferred in the type of Markov model used here.

APPENDIX B

CALCULATING MISSING YEAR GROUPS
PART I

MEDICAL SERVICE CORPS DATA

Two data elements were essential for each officers record, year group and grade. As stated in Chapter 2, section D1, the year group was used for computing years of service instead of the active commissioned base date. Because of constructive credit, the year group will provide a more accurate projection of when the officer will be in zone for promotion. With the emphasis of this research on testing the impact of different policy changes on promotion, the year group is more appropriate than the active federal years of service towards retirement.

The first step was to determine how many records had the year group missing. Looking at each of the five fiscal years of data separately, there were 85 missing in 1989, 132 in 1988, 102 in 1987, 91 in 1986 and 19 in 1985. The year 1985 didn't present a major problem, but the other years had far too many observations to delete that many records from the inventories.

The next step was to merge the data sets together. This way, as the data set was updated, the missing information was entered into the record in subsequent years. The results following the merge was much better than when using the separate records. Only the year 1989 did still present a problem, because 1990 data were

not available for comparison. The year group was still missing from 83 records. It was considered unacceptable to delete this many of the 1989 records, as this year was the most current data and thought to be the most important.

The next consideration was to develop an algorithm to compute the missing year groups based on other data that was available in the record. The data fields used were the active commission base date, source of commission, paygrade, level of education, subspecialty, and report date. The following SAS algorithm, called MSCALGO was develped:

```
IF YRGRP='00' AND GRADE84='L' AND ('01' LE SUBSTR(DOR84,3,2) LE '09') THEN     YRGRP=(FY-1);
IF YRGRP='00' AND GRADE84='L' AND (SUBSTR(DOR84,3,2) GE '10') THEN YRGRP=FY;
IF YRGRP='00' AND GRADE84='L' AND (DOR84=' ' OR DOR84='000000') THEN YRGRP=FY;
IF YRGRP='00' AND GRADE84='K' AND ('01' LE SUBSTR(DOR84,3,2) LE '09') THEN YRGRP=(SUBSTR(DOR84,1,2)-2);
IF YRGRP='00' AND GRADE84='K' AND (SUBSTR(DOR84,3,2) GE '10') THEN YRGRP=(SUBSTR(DOR84,1,2)-1);
IF YRGRP='00' AND GRADE84='K' AND (DOR84=' ' OR DOR84='000000') THEN YRGRP=SUBSTR(RPD84,1,2);
IF YRGRP='00' AND GRADE84='J' AND ('01' LE SUBSTR(DOR84,3,2) LE '09') THEN YRGRP=(SUBSTR(DOR84,1,2)-4);
IF YRGRP='00' AND GRADE84='J' AND (SUBSTR(DOR84,3,2) GE '10') THEN YRGRP=(SUBSTR(DOR84,1,2)-3);
IF YRGRP='00' AND GRADE84='J' AND (DOR84=' ' OR DOR84='000000') AND (SUBSTR(XSUBS184,1,5)='OPTOM' OR
SUBSTR(XSUBS184,1,8)='CLN PSYC' OR SUBSTR(XSUBS184,1,7)='PHYSIOL' OR SUBSTR(XSUBS184,1,3)='POD' OR
SUBSTR(XSUBS184,1,8)='MICROBIO' OR SUBSTR(XSUBS184,1,8)='RSCHPSYC') THEN YRGRP=(SUBSTR(RPD84,1,2)-4);
IF YRGRP='00' AND GRADE84='I' AND DOR84 GT '000001' THEN YRGRP=(SUBSTR(DOR84,1,2)-10);
IF YRGRP='00' AND GRADE84='H' AND (SOE='10' OR SOE='30') THEN YRGRP=SUBSTR(ACBD,1,2);
IF YRGRP='00' AND GRADE84='G' AND (SOE='10' OR SOE='30') THEN YRGRP=SUBSTR(ACBD,1,2);
IF YRGRP='00' AND GRADE84='F' AND (SOE='10' OR SOE='30') THEN YRGRP=SUBSTR(ACBD,1,2);
IF YRGRP='00' AND GRADE84='E' AND (SOE='10' OR SOE='30') THEN YRGRP=SUBSTR(ACBD,1,2);
```

The algorithm only computes the year group for lieutenants, lieutenants junior grade and ensigns. There are far too many variables to consider for the more senior grade officers. If the year group was missing on these senior officers, the record was deleted from the inventory. This resulted in only 3 records being deleted. The only exception to this practice was for those members commissioned through the inservice procurement program. If the active commission base date was availaibe, this was used to compute the year group on senior officers as well.

After developing the algorithm, a test was conducted on the 1987 data. Selection of this year was arbitrary. A program was developed for SAS that would erase all the year groups from the 1987 data set. Then, the algorithm recalculated the year group. The computed results were compared with the orginal 1987 data set. Only a sample was actually compared, using a random sampling feature available in the SAS software. Two hundred fifty records were selected from the 2500 available. The algorithm, MSCALGO (shown above), recomputed the missing year groups with a 90 percent accuracy rate. Only 25 errors were found in the sample of 250 records. Of these 25 errors, 21 of the year groups were calculated with an error of plus or minus one year of service.

Table B.1 displays the results before and after using the algorithm. In 1989, the 83 records with missing year group represented only 3 percent of the data. By using the algorithm, approximately 90 percent of the missing year groups were correctly computed. The remaining error represents less than one tenth of one percent of the data.

TABLE B1 NUMBER OF RECORDS MISSING THE YEAR GROUP

Year	Missing from Separate Files	Missing from Merged File	Missing after algorithm
1985	19	16	1
1986	91	8	0
1987	102	5	0
1988	132	11	1
1989	83	83	1
Total	427	123	3

PART II

PHYSICIAN ASSISTANT DATA

The physician assistant data that was merged with the Medical Service Corps data had 96 of the 97 records missing the year group. Using the same procedure as the conversion board, another algorithm, called PA_ALGO was developed to compute these year groups [Ref. 12]. All but six missing year groups were computed by the PA_ALGO algorithm; these six were computed by hand. The following SAS code was used to compute these year groups:

```
IF YRGRP-'00' AND GRADE88-'M' AND SUBSTR(DOR88,1,4) LT 8409 THEN YRGRP-FY-7;
IF YRGRP-'00' AND GRADE88-'M' AND (SUBSTR(DOR88,1,4) GE 8409 AND SUBSTR(DOR88,1,4) LE 8508) THEN
YRGRP-FY-6;
IF YRGRP-'00' AND GRADE88-'M' AND (SUBSTR(DOR88,1,4) GE 8509 AND SUBSTR(DOR88,1,4) LE 8703) THEN
YRGRP-FY-5;
IF YRGRP-'00' AND GRADE88-'M' AND SUBSTR(DOR88,1,4) GE 8704 THEN YRGRP-FY-4;
IF YRGRP-'00' AND GRADE88-'N' AND SUBSTR(DOR88,1,4) LE 8609 THEN YRGRP-FY-3;
IF YRGRP-'00' AND GRADE88-'N' AND SUBSTR(DOR88,1,4) LE 8610 THEN YRGRP-FY-2;
IF YRGRP-'00' AND GRADE88-'O' THEN YRGRP-FY-1;
```

APPENDIX C

SAS PROGRAM CODE

```
//FINAL85 JOB (8663,9999),'BUTLER',CLASS=C
//*MAIN SYSTEM=SY2,LINES=(999)
//    EXEC SAS,REGION=2000K
//WORK    DD UNIT=SYSDA,SPACE=(CYL,(20,20))
//ALL     DD DISP=SHR,DSN=MSS.S8663.ALLMSC
//SYSIN DD *

DATA ONE85;
SET ALL.ALLMSC(READ=HEALTH);
IF YEAR85='1';
IF GRADE85=' ' AND GRADE86=' ' THEN DELETE;
IF GRADE85=' ' THEN GRADE85=GRADE86;
IF GRADE85 NE ' ' AND GRADE86=' ' THEN DELETE;
IF XSUBS185=' ' THEN XSUBS185=XSUBS186;
IF SUBSP185=' ' THEN SUBSP185=SUBSP186;
IF DELCD84='1' AND ELD84 LT 8410 THEN DELETE;

DATA TWO85;
SET ONE85;

* REMOVE LOSSES PRIOR TO FY85 AND MISCODED DELETIONS;

IF DELCD85='1' AND ELD85 LT 8410 THEN DELETE;
IF DELCD86='1' AND ELD86 LT 8410 THEN DELETE;

* REMOVE ACCESSIONS INTO FY85;

IF DELCD84='2' AND (RPD84 GE 8410 AND RPD84 LE 8509) THEN DELETE;
IF DELCD84='2' AND RPD84=' ' THEN DELETE;
IF DELCD85='2' AND RPD85 GT 8509 THEN DELETE;
IF (RPD85 GE 8410 AND RPD85 LE 8509) AND (YEAR85='1' AND
YEAR84 NE '1') THEN DELETE;
DATA FY (KEEP=FY);
SET TWO85;
FY=85;

DATA THREE85;
SET TWO85;
IF _N_=1 THEN SET FY;
IF YRGRP=. THEN YRGRP='00';
```

90

* ALGORITHM TO COMPUTE MISSING YEAR GROUPS

```
DATA FOUR85;
SET THREE85;
IF YRGRP='00' AND GRADE85='L' AND ('01' LE SUBSTR(DOR85,3,2) LE
'09')
 THEN YRGRP=(FY-1);
IF YRGRP='00' AND GRADE85='L' AND (SUBSTR(DOR85,3,2) GE '10')
 THEN YRGRP=FY;
IF YRGRP='00' AND GRADE85='L' AND (DOR85=' ' OR DOR85='000000')
 THEN YRGRP=FY;
IF YRGRP='00' AND GRADE85='K' AND ('01' LE SUBSTR(DOR85,3,2) LE
'09')
 THEN YRGRP=(SUBSTR(DOR85,1,2)-2);
IF YRGRP='00' AND GRADE85='K' AND (SUBSTR(DOR85,3,2) GE '10')
 THEN YRGRP=(SUBSTR(DOR85,1,2)-1);
IF YRGRP='00' AND GRADE85='K' AND (DOR85=' ' OR DOR85='000000')
 THEN YRGRP=SUBSTR(RPD85,1,2);
IF YRGRP='00' AND GRADE85='J' AND ('01' LE SUBSTR(DOR85,3,2) LE
'09')
 THEN YRGRP=(SUBSTR(DOR85,1,2)-4);
IF YRGRP='00' AND GRADE85='J' AND (SUBSTR(DOR85,3,2) GE '10')
 THEN YRGRP=(SUBSTR(DOR85,1,2)-3);

IF YRGRP='00' AND GRADE85='J' AND (DOR85=' ' OR DOR85='000000')
AND (SUBSTR(XSUBS185,1,5)='OPTOM' OR SUBSTR(XSUBS185,1,8)='CLN
PSYC'
OR SUBSTR(XSUBS185,1,7)='PHYSIOL' OR SUBSTR(XSUBS185,1,3)='POD'
OR    SUBSTR(XSUBS185,1,8)='MICROBIO'    OR
SUBSTR(XSUBS185,1,8)='RSCHPSYC')
 THEN YRGRP=(SUBSTR(RPD85,1,2)-4);

IF YRGRP='00' AND GRADE85='I' AND DOR85 GT '000001' THEN
YRGRP=(SUBSTR(DOR85,1,2)-10);

IF YRGRP='00' AND GRADE85='H' AND (SOE='10' OR SOE='30') THEN
 YRGRP=SUBSTR(ACBD,1,2);
IF YRGRP='00' AND GRADE85='G' AND (SOE='10' OR SOE='30') THEN
 YRGRP=SUBSTR(ACBD,1,2);
IF YRGRP='00' AND GRADE85='F' AND (SOE='10' OR SOE='30') THEN
 YRGRP=SUBSTR(ACBD,1,2);
IF YRGRP='00' AND GRADE85='E' AND (SOE='10' OR SOE='30') THEN
 YRGRP=SUBSTR(ACBD,1,2);

DATA FIVE85;
SET FOUR85;
YOCS=FY-YRGRP;
PROC FREQ;
TABLES YOCS*GRADE85;
```

```
* PRINTS A LOG OF RECORDS STILL MISSING THE YEAR GROUP AFTER THE
ALGORITHM IS COMPLETE

DATA MISSING;
SET FIVE85;
IF YRGRP='00';
PROC SORT;
BY XSUBS185 GRADE85;
PROC PRINT;
VAR SSN YOCS GRADE85 DOR85 XSUBS185 PEBD ADBD ACBD SOE YRGRP
  RPD85;
TITLE 'FILES WITH MISSING YEAR GROUP';


* HEALTH CARE ADMINISTRATION INVENTORY

DATA HCA85;
SET FIVE85;
TITLE 'HCA INVENTORY';
IF SUBSTR(SUBSP185,1,4) = '1800' OR SUBSTR(SUBSP185,1,4) = '1801'
OR SUBSTR(SUBSP185,1,4) = '1802' OR SUBSTR(SUBSP185,1,4) = '1803'
OR SUBSTR(SUBSP185,1,4) = '1804' OR SUBSTR(SUBSP185,1,4) = '1805'
OR SUBSTR(SUBSP185,1,4) = '1806' OR SUBSTR(SUBSP185,1,4) = '0031'
OR SUBSTR(SUBSP185,1,4) = '0032' OR SUBSTR(SUBSP185,1,4) = '0033'
OR SUBSTR(SUBSP185,1,4) = '0036' OR SUBSTR(SUBSP185,1,4) = '0037'
OR SUBSTR(SUBSP185,1,4) = '0038' OR SUBSTR(SUBSP185,1,4) = '0039'
OR SUBSTR(SUBSP185,1,4) = '1808' OR SUBSTR(SUBSP185,1,4) = '0091'
OR SUBSTR(SUBSP185,1,4) = '1818' OR SUBSTR(SUBSP185,1,4) = '1812'
OR SUBSTR(SUBSP185,1,4) = '1820' OR SUBSTR(SUBSP185,1,4) = '1814'
OR SUBSTR(SUBSP185,1,4) = '1822' OR SUBSTR(SUBSP185,1,4) = '1877'
OR SUBSTR(SUBSP185,1,4) = '1837'
OR SUBSTR(SUBSP185,1,4) = '0090' OR SUBSTR(SUBSP185,1,4) = '0095';
PROC FREQ;
TABLES YOCS*GRADE85;

* HEALTH SCIENCE INVENTORY

DATA HS85;
SET FIVE85;
TITLE 'HS INVENTORY';
IF  SUBSTR(SUBSP185,1,4)  NE  '1800'  AND  SUBSTR(SUBSP185,1,4)  NE
'1801'
AND  SUBSTR(SUBSP185,1,4)  NE  '1802'  AND  SUBSTR(SUBSP185,1,4)  NE
'1803'
AND  SUBSTR(SUBSP185,1,4)  NE  '1804'  AND  SUBSTR(SUBSP185,1,4)  NE
'1805'
AND  SUBSTR(SUBSP185,1,4)  NE  '1806'  AND  SUBSTR(SUBSP185,1,4)  NE
'0031'
AND  SUBSTR(SUBSP185,1,4)  NE  '0032'  AND  SUBSTR(SUBSP185,1,4)  NE
'0033'
AND  SUBSTR(SUBSP185,1,4)  NE  '0036'  AND  SUBSTR(SUBSP185,1,4)  NE
'0037'
```

```
AND  SUBSTR(SUBSP185,1,4)  NE  '0038'  AND  SUBSTR(SUBSP185,1,4)  NE
'0039'
AND  SUBSTR(SUBSP185,1,4)  NE  '1808'  AND  SUBSTR(SUBSP185,1,4)  NE
'0001'
AND  SUBSTR(SUBSP185,1,4)  NE  '1818'  AND  SUBSTR(SUBSP185,1,4)  NE
'1812'
AND  SUBSTR(SUBSP185,1,4)  NE  '1820'  AND  SUBSTR(SUBSP185,1,4)  NE
'1814'
AND  SUBSTR(SUBSP185,1,4)  NE  '1822'  AND  SUBSTR(SUBSP185,1,4)  NE
'1877'
AND SUBSTR(SUBSP185,1,4) NE '1837'
AND  SUBSTR(SUBSP185,1,4)  NE  '0090'  AND  SUBSTR(SUBSP185,1,4)  NE
'0095';
PROC FREQ;
TABLES YOCS*GRADE85;
```

* RECORD OF THOSE ELIGIBLE FOR PROMOTION   (NOT ACTUALLY USED IN THE CALCULATIONS OF PROMOTION RATES)

```
DATA PROM85;
SET FIVE85;
IF PROM85 = 'S6' OR PROM85 ='F6';
TITLE 'ELIG FOR PROMOTIONS BY YOS IN AGGREGATE';
PROC FREQ;
TABLES YOCS*GRADE85;
PROC SORT;
BY GRADE85 PROM85 PRECN85;
PROC PRINT;
VAR SSN PROM85 GRADE85 PRECN85 YRGRP SOE XSUBS185 DELCD85 ELD85
 RPD85 DELCD86 ELD86;
```

*   ACTUAL SELECTIONS ;

```
DATA SELECT;
SET FIVE85;
IF PROM85='S6';
TITLE 'SELECTED FOR PROMOTIONS BY YOS IN AGGREGATE';
PROC FREQ;
TABLES YOCS*GRADE85;
```

* PROMOTION CODING REPEATED FOR THE HCA AND HS DATA

```
DATA HPROM85;
SET HCA85;
IF PROM85 = 'S6' OR PROM85 ='F6';
TITLE 'ELIG FOR PROMOTIONS BY YOS IN HCA';
PROC FREQ;
TABLES YOCS*GRADE85;
PROC SORT;
BY GRADE85 PROM85 PRECN85;
```

93

```
PROC PRINT;
VAR SSN PROM85 GRADE85 PRECN85 YRGRP SOE XJUBS185 DELCD85 ELD85
 RPD85 DELCD86 ELD86;
*  ACTUAL SELECTIONS ;
DATA SELECT;
SET HPROM85;
IF PROM85='S6';
TITLE 'SELECTED FOR PROMOTIONS BY YOS IN HCA';
PROC FREQ;
TABLES YOCS*GRADE85;

DATA HSPROM85;
SET HS85;
IF PROM85 = 'S6' OR PROM85 ='F6';
TITLE 'ELIG FOR PROMOTIONS BY YOS IN HS';
PROC FREQ;
TABLES YOCS*GRADE85;
PROC SORT;
BY GRADE85 PROM85 PRECN85;
PROC PRINT;
VAR SSN PROM85 GRADE85 PRECN85 YRGRP SOE XSUBS185 DELCD85 ELD85
 RPD85 DELCD86 ELD86;
 *  ACTUAL SELECTIONS ;
DATA SELECT;
SET HSPROM85;
IF PROM85='S6';
TITLE 'SELECTED FOR PROMOTIONS BY YOS IN HS';
PROC FREQ;
TABLES YOCS*GRADE85;

* CODE TO EXTRACT THE LOSSES

DATA LOSS85;
SET FIVE85;
IF (DELCD85='1' AND (ELD85 GE 8410 AND
 ELD85 LE 8509)) OR
(DELCD86='1' AND (ELD86 GE 8410 AND
 ELD86 LE 8509));
TITLE 'ATTRITION IN AGGREGATE';
PROC SORT;
BY XSUBS185;
PROC PRINT;
VAR SSN DELCD85 ELD85 DELCD86 ELD86 XSUBS185 GRADE85 YRGRP YOCS;
PROC FREQ;
TABLES YOCS*GRADE85;

DATA HLOSS85;
SET HCA85;
IF (DELCD85='1' AND (ELD85 GE 8410 AND
 ELD85 LE 8509)) OR
(DELCD86='1' AND (ELD86 GE 8410 AND
```

94

```
 ELD86 LE 8509));
TITLE 'ATTRITION IN HCA';
PROC SORT;
BY XSUBS185;
PROC PRINT;
VAR SSN DELCD85 ELD85 DELCD86 ELD86 XSUBS185 GRADE85 YRGRP YOCS;
PROC FREQ;
TABLES YOCS*GRADE85;

DATA HSLOS85;
SET HS85;
IF (DELCD85='1' AND (ELD85 GE 8410 AND
 ELD85 LE 8509)) OR
(DELCD86='1' AND (ELD86 GE 8410 AND
 ELD86 LE 8509));
TITLE 'ATTRITION IN HS';
PROC SORT;
BY XSUBS185;
PROC PRINT;
VAR SSN DELCD85 ELD85 DELCD86 ELD86 XSUBS185 GRADE85 YRGRP YOCS;
PROC FREQ;
TABLES YOCS*GRADE85;
```

* CODE TO COUNT ACCESSIONS

```
//ACS85 JOB (8663,9999),'BUTLER',CLASS=B
//*MAIN SYSTEM=SY2,LINES=(999)
//    EXEC SAS,REGION=2000K
//WORK    DD UNIT=SYSDA,SPACE=(CYL,(20,20))
//ALL     DD DISP=SHR,DSN=MSS.S8663.ALLMSC
//SYSIN DD *

DATA ONE85;
SET ALL.ALLMSC(READ=HEALTH);
IF GRADE85=' ' AND GRADE86=' ' THEN DELETE;
IF GRADE85=' ' THEN GRADE85=GRADE86;
IF GRADE85 NE ' ' AND GRADE86=' ' THEN DELETE;
IF XSUBS185=' ' THEN XSUBS185=XSUBS186;
IF SUBSP185=' ' THEN SUBSP185=SUBSP186;

DATA TWO85;
SET ONE85;
IF DELCD84='1' OR
 DELCD85='1' THEN DELETE;
IF DELCD85='2' AND RPD85 GT 8509 THEN DELETE;

DATA FOUR85;
SET TWO85;
IF (DELCD84='2' AND YEAR85='1' AND ((RPD84 GE 8410 AND RPD84 LE
8509)
  OR RPD84 = ' '))
OR ((RPD85 GE 8410 AND RPD85 LE 8509) AND (YEAR84 NE '1' AND
```

```
YEAR85='1'));

DATA FY (KEEP=FY);
SET FOUR85;
FY=85;

DATA FIVE85;
SET FOUR85;
IF _N_=1 THEN SET FY;
IF YRGRP=. THEN YRGRP='00';

DATA ALGO85;
SET FIVE85;
IF YRGRP='00' AND GRADE85='L' AND ('01' LE SUBSTR(DOR85,3,2) LE
'09')
 THEN YRGRP=(FY-1);
IF YRGRP='00' AND GRADE85='L' AND (SUBSTR(DOR85,3,2) GE '10')
 THEN YRGRP=FY;
IF YRGRP='00' AND GRADE85='L' AND (DOR85=' ' OR DOR85='000000')
 THEN YRGRP=FY;
IF YRGRP='00' AND GRADE85='K' AND ('01' LE SUBSTR(DOR85,3,2) LE
'09')
 THEN YRGRP=(SUBSTR(DOR85,1,2)-2);
IF YRGRP='00' AND GRADE85='K' AND (SUBSTR(DOR85,3,2) GE '10')
 THEN YRGRP=(SUBSTR(DOR85,1,2)-1);
IF YRGRP='00' AND GRADE85='K' AND (DOR85=' ' OR DOR85='000000')
 THEN YRGRP=SUBSTR(RPD85,1,2);
IF YRGRP='00' AND GRADE85='J' AND ('01' LE SUBSTR(DOR85,3,2) LE
'09')
 THEN YRGRP=(SUBSTR(DOR85,1,2)-4);
IF YRGRP='00' AND GRADE85='J' AND (SUBSTR(DOR85,3,2) GE '10')
 THEN YRGRP=(SUBSTR(DOR85,1,2)-3);
IF YRGRP='00' AND GRADE85='J' AND (DOR85=' ' OR DOR85='000000')
AND  (SUBSTR(XSUBS185,1,5)='OPTOM'  OR  SUBSTR(XSUBS185,1,8)='CLN
PSYC'
OR SUBSTR(XSUBS185,1,7)='PHYSIOL' OR SUBSTR(XSUBS185,1,3)='POD'
OR   SUBSTR(XSUBS185,1,8)='MICROBIO'   OR   SUBSTR(XSUBS185,1,8)
='RSCHPSYC')
 THEN YRGRP=(SUBSTR(RPD85,1,2)-4);
IF YRGRP='00' AND GRADE85='I' AND DOR85 GT '000001' THEN
YRGRP=(SUBSTR(DOR85,1,2)-10);
IF YRGRP='00' AND GRADE85='H' AND (SOE='10' OR SOE='30') THEN
 YRGRP=SUBSTR(ACBD,1,2);
IF YRGRP='00' AND GRADE85='G' AND (SOE='10' OR SOE='30') THEN
 YRGRP=SUBSTR(ACBD,1,2);
IF YRGRP='00' AND GRADE85='F' AND (SOE='10' OR SOE='30') THEN
 YRGRP=SUBSTR(ACBD,1,2);
IF YRGRP='00' AND GRADE85='E' AND (SOE='10' OR SOE='30') THEN
 YRGRP=SUBSTR(ACBD,1,2);
```

```
DATA SIX85;
SET ALGO85;
YOCS=FY-YRGRP;
PROC FREQ;
TABLES YOCS*GRADE85;
PROC SORT;
BY XSUBS185 GRADE85;
PROC PRINT;
VAR SSN PROM85 PROM86 GRADE85 GRADE86 GRADE87 XSUBS185 YRGRP RPD85
 DELCD85 DELCD84 RPD84 SOE;
TITLE 'ACCESSIONS IN AGGREGATE';
```

*** PRINTS A LOG OF ENSIGN ACCESSIONS AND THEIR GRADE FOR TWO
CONSECUTIVE YEARS. THIS INFORMATION WAS USED TO ACCESS THE OFFICER
AT THE PROMOTED PAYGRADE.** (See Appendix A)

```
DATA ENSIGNS;
SET SIX85;
IF GRADE85='L';
PROC SORT;
BY YRGRP;
PROC PRINT;
VAR SSN GRADE85 GRADE86 GRADE87 XSUBS185 YRGRP RPD85 DELCD85
PROM85 PROM86 SOE;
TITLE 'ENSIGN ACCESSIONS';
```

* PRINTS A LOG OF RECORDS STILL MISSING YEAR GROUP

```
DATA MISSING;
SET SIX85;
IF YRGRP='00';
PROC SORT;
BY XSUBS185 GRADE85;
PROC PRINT;
VAR SSN GRADE85 DOR85 XSUBS185 PEBD ADBD ACBD SOE YRGRP
  RPD85;
TITLE 'FILES WITH MISSING YEAR GROUP AFTER ALGO';
```

*** PRINTS A LOG OF DESIGNATOR CHANGES. THIS INFORMATION IS USE TO
RECORD GAINS AND LOSSES FROM THE TWO SUBCOMMUNITIES.**

```
DATA CHANGE;
SET TWO85;
IF SUBSTR(SUBSP184,1,4) NE SUBSTR(SUBSP185,1,4) AND
(YEAR84='1' AND YEAR85='1');
PROC SORT;
BY XSUBS184;
PROC PRINT;
VAR SSN XSUBS184 XSUBS185 YRGRP SOE GRADE84 GRADE85 RPD84 RPD85;
TITLE 'SUBSPECIALTY CODE CHANGES FROM 1984 TO 1985';
```

```
*   UNIQUE CODE FOR ACCESSIONS IN 1989 TO COUNT THE PHYSICIAN
ASSISTANTS

//ACS89 JOB (8663,9999),'BUTLER',CLASS=B
//*MAIN SYSTEM=SY2,LINES=(999)
//   EXEC SAS,REGION=2000K
//WORK   DD UNIT=SYSDA,SPACE=(CYL,(20,20))
//ALL    DD DISP=SHR,DSN=MSS.S8663.ALLMSC
//ALL2   DD DISP=SHR,DSN=MSS.S8663.MSCPA
//SYSIN DD *

DATA PAACS89;
SET ALL2.MSCPA(READ=HEALTH);
IF SUBSTR(XSUBS189,1,8)='PHYSASST';

DATA TWO89;
SET PAACS89;
IF DELCD88='1' OR
 DELCD89='1' THEN DELETE;
IF DELCD89='2' AND RPD89 GT 8909 THEN DELETE;

DATA FY (KEEP=FY);
SET TWO89;
FY=89;

DATA FIVE89;
SET TWO89;
IF _N_=1 THEN SET FY;
IF YRGRP=. THEN YRGRP='00';

DATA ALGO89;
SET FIVE89;
IF YRGRP='00' AND GRADE88='M' AND SUBSTR(DOR88,1,4)
     LT 8409 THEN YRGRP=FY-7;
IF YRGRP='00' AND GRADE88='M' AND (SUBSTR(DOR88,1,4) GE 8409 AND
SUBSTR(DOR88,1,4) LE 8508) THEN YRGRP=FY-6;
IF YRGRP='00' AND GRADE88='M' AND (SUBSTR(DOR88,1,4) GE 8509 AND
SUBSTR(DOR88,1,4) LE 8703) THEN YRGRP=FY-5;
IF YRGRP='00' AND GRADE88='M' AND SUBSTR(DOR88,1,4) GE 8704
THEN YRGRP=FY-4;
IF YRGRP='00' AND GRADE88='N' AND SUBSTR(DOR88,1,4) LE 8609
THEN YRGRP=FY-3;
IF YRGRP='00' AND GRADE88='N' AND SUBSTR(DOR88,1,4) LE 8610
THEN YRGRP=FY-2;
IF YRGRP='00' AND GRADE88='O' THEN YRGRP=FY-1;

DATA SIX89;
SET ALGO89;
YOCS=FY-YRGRP;
PROC FREQ;
TABLES YOCS*GRADE89;
PROC SORT;
```

```
BY XSUBS189 GRADE89;
PROC PRINT;
VAR SSN PROM89 GRADE88 GRADE89 DOR88 DOR89 YRGRP RPD89 DELCD89 SOE;
TITLE 'ACCESSIONS IN AGGREGATE';

DATA MISSING;
SET SIX89;
IF YRGRP='00';
PROC SORT;
BY XSUBS189 GRADE89;
PROC PRINT;
VAR SSN GRADE88 GRADE89 DOR89 XSUBS189 PEBD ADBD ACBD SOE YRGRP
   RPD89;
TITLE 'FILES WITH MISSING YEAR GROUP AFTER ALGO';

* PRINTS A LOG OF ANY RECORD MISSING THE GRADE

DATA NOGRADE;
SET PAACS89;
IF GRADE89 =' ' OR XSUBS189 =' ' OR SUBSP189=' ';
PROC PRINT;
VAR SSN GRADE88 GRADE89 XSUBS189 SUBSP189 YRGRP RPD89 ;
TITLE 'PA RCDS MISSING GRADE OR SPECIALTY FOR CURRENT YEAR';
```

APPENDIX D

SUBSPECIALTY CODES USED IN BUMIS DATA FILES

A. HEALTH CARE ADMINISTRATION

SUBSPECIALTY	CODES 1985-1987	CODES 1988-1989
General management	0030	0030
Financial management	0031	0031
Material logistics support	0032	0032
Manpower,personnel and training analysis	0033	0033
Transportation management	0035	0035
Manpower and personnel	0036	0036
Education and training	0037	0037
Human resources management	0038	0038
Computer technology, general	0090	0090
Computer technology, science	0091	0091
Computer technology, systems	0095	0095
Professional health care administration	1800	1800
Patient affairs	1808	1801
Medical supply/logistics	1812	1802
Administrative dietetics	1814,1877	1877
Medical data services	1818	1803
Operations management	1820	
Medical construction liaison	1822	1804
Educational systems management	1837	

B. HEALTH SCIENCE

SUBSPECIALTY	CODES 1985-1987	CODES 1988-1989
Biochemistry	1840	1810
Toxicology		1811
Pharmacology	1843	
Microbiology	1841	1815
Epidemiology		1816
Immunology		1817
Parasitology		1819
Virology		1821
Radiation health	1845	1825

SUBSPECIALTY	CODES 1985-1987	CODES 1988-1989
Radiation survey, ionizing		1826
Radiation survey non-ionizing		1827
Radiation specialist	1847	1828
Physiology	1848	1835
Aerospace physiology	1849	1836
Aerospace physiology, education	1850	
Clinical psychology	1851	1840
Child psychology	1852	1841
Neuropsychology		1842
Medical psychology		1843
Aerospace experimental psychology	1852	1844
Research psychology	1854	1845
Entomology	1860	1850
Environmental health	1861	1860
Industrial hygiene	1862	1861
Medical technology	1866	1865
Immunohematology	1867	1865
Social work	1868	1870
Audiology	1871	1862
Physical therapy	1873	1873
Occupational therapy	1874	1874
Dietetics	1876	1876
Optometry	1880	1880
Optometry, industrial	1881	
Pharmacy, general	1887	1887
Pharmacy, clinical	1888	1888
Pharmacy, radio	1889	
Podiatry	1892	1892

APPENDIX E

CONTINUATION RATES, PROMOTION RATES AND BEGINNING INVENTORIES

A. MSC SCENARIO CONTINUATION RATES

YOS	ENS	LTJG	LT	LCDR	CDR	CAPT
1	1.000					
2	0.833	0.994				
3		0.956				
4		0.821	0.962			
5		0.334	0.928			
6			0.956			
7			0.890			
8			0.905			
9			0.954			
10			0.946	1.000		
11			0.659	0.974		
12			0.188	0.955		
13				0.947		
14				0.950		
15				0.952	1.000	
16				0.827	0.980	
17				0.886	0.972	
18				0.889	0.900	
19				0.948	0.923	
20				0.769	0.927	1.000
21				0.333	0.949	1.000
22					0.844	1.000
23					0.737	0.875
24					0.600	0.733
25					1.000	0.714
26						1.000
27						0.917
28						1.000
29						0.556
30						0.250
31						0.667

B. HCA SCENARIO CONTINUATION RATES

YOS	ENS	LTJG	LT	LCDR	CDR	CAPT
1	0.980		1.000			
2	1.000	0.984				
3		0.980				
4		0.955	0.986			
5			0.922			
6			0.960			
7			0.948			
8			0.939			
9			0.983			
10			0.946	1.000		
11			0.762	0.990		
12			0.250	0.924		
13				0.920		
14				0.918		
15				0.920	0.974	
16				0.790	0.977	
17				0.812	0.943	
18				0.750	0.870	
19				0.750	0.955	
20				1.000	0.938	1.000
21					0.923	1.000
22					0.800	1.000
23					1.000	0.849
24					1.000	0.722
25						0.750
26						1.000
27						0.889
28						1.000
29						0.667
30						0.250
31						0.500

C. JUNIOR OFFICER PROMOTION RATES FOR MSC SCENARIO

YOS	ENS	LTJG
1	0.950	
2	0.980	0.005
3		0.916
4		0.231
5		0.167

D. JUNIOR OFFICER PROMOTION RATES FOR HCA SCENARIO

YOS	ENS	LTJG
1	0.950	
2	0.980	0.008
3		0.926
4		0.227

E. PROJECTED FISCAL YEAR 1990 MSC BEGINNING INVENTORY

YOS	ENS	LTJG	LT	LCDR	CDR	CAPT	ALL
1.	117	12					129
2.	20	135					155
3.		92	2				94
4.		27	177				204
5.		7	165				172
6.			194				194
7.			213				213
8.			178				178
9.			143	1			144
10.			68	42			110
11.			24	85			109
12.			17	74			91
13.			3	139			142
14.				70			70
15.				67	2		69
16.				21	42		63
17.				36	100		136
18.				17	56		73
19.				19	43	3	65
20.				11	24	16	51
21.				4	17	25	46
22.				2	13	15	30
23.					21	33	54
24.					5	25	30
25.					5	18	23
26.					1	2	3
27.						3	3
28.						7	7
29.						4	4
30.						2	2
31.						1	1
TOTALS	137	273	1184	588	329	154	2665

F. PROJECTED FISCAL YEAR 1990 HCA BEGINNING INVENTORY

YOS	ENS	LTJG	LT	LCDR	CDR	CAPT	ALL
1.	72	4					76
2.	4	80					84
3.		42	1				43
4.		12	122				134
5.		2	71				73
6.			86				86
7.			115				115
8.			79				79
9.			82				82
10.			36	19			55
11.			13	46			59
12.			9	33			42
13.			2	62			64
14.				33			33
15.				30	1		31
16.				8	26		34
17.				16	63		79
18.				8	30		38
19.				4	14	3	21
20.				1	20	1	22
21.				2	8	13	23
22.					4	10	14
23.					6	22	28
24.					2	14	16
25.					1	10	11
26.						2	2
27.						1	1
28.						5	5
29.						3	3
30.						1	1
31.						1	1
TOTALS	76	140	661	262	175	86	1355

106

FORCE MODEL USER GUIDE

WITH MSC WORKSPACE AND DATA FILES
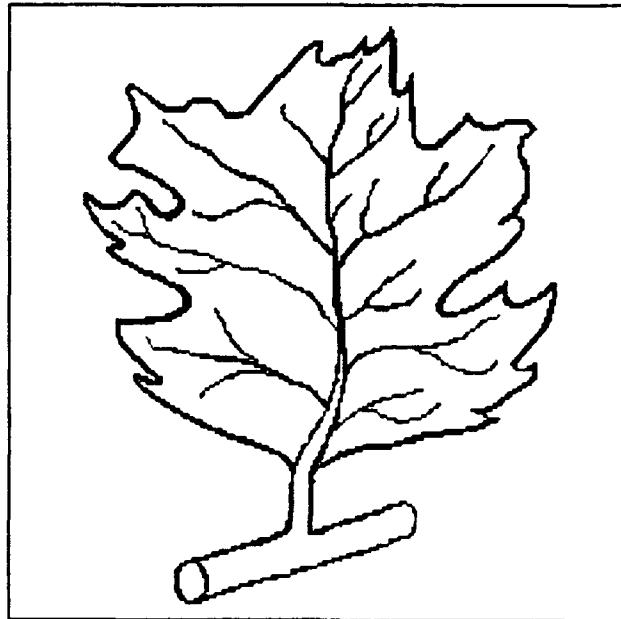
This manual is developed in conjunction with the thesis titled "The Impact of Force Reductions on Promotions in the Navy Medical Service Corps." The information contained within this manual is applicable to the force structure model, "FORCE", which was designed by Professor Paul R. Milch, at the Naval Postgraduate School, Monterey, CA. The model is designed for use on an IBM compatible computer with a DOS operating system. The computer model was written in APL (A programming language).

A. GETTING STARTED

1. Making backup copies of your disks.

The original disk containing the program and data files should not be used. A working copy of this disk should be made and the original stored safely away from the computer. To make a copy of the original disk:

Two floppy drive system:
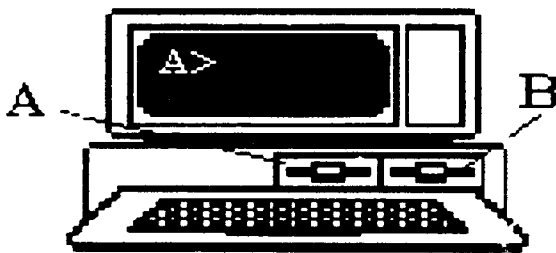
Place the original disk in drive A
Place a formatted blank disk in drive B

At the prompt A>, type "COPY A:*.* B:" [1] and press [ENTER]

The files contained on the original disk are:

```
APL.EXE
ECDCHAR.COM
ORIGCHAR.COM
MSC.BAT
MSC.AWS
ALLBLANK.AWS
MSCFY85.AWS  through  MSCFY89.AWS
HCA85.AWS  through  HCA89.AWS
HTHSC85.AWS  through  HTHSC89.AWS
```

2. Starting from a floppy disk drive.

Place the working diskette into drive A, and type "MSC" and press [ENTER]. The MSC.BAT file will load the APL language and the APL keyboard character set. Once this

---

[1]Throughout this manual, instructions to be typed will be offset by " " and keys will be represent by [ ]. Do not type the apostrophes or brackets with the text when using this software.

keyboard character set is loaded, the symbols, numbers and characters displayed on your keyboard will not be the same when you use the SHIFT, ALT, or CTRL key in combination with these keys. For example, if you hold the SHIFT key and press the number eight, you expect to see the * symbol. Once the APL keyboard character set is loaded, this will not be the case. Do not be alarmed by this change. Your normal keyboard functions will return when you exit from this program.

The first screen will display a software disclaimer. At this point, type the word "FORCE" and press [ENTER]. You will see the following:

```
DO YOU WISH TO VIEW THE BRIEF INSTRUCTIONS?
IF YES ANSWER 'Y' AND HIT ENTER, OTHERWISE JUST HIT
ENTER
```

If you select 'Y', you will receive the following instructions:

```
                WELCOME TO THE F O R C E MODEL

IF YOU ARE USING THIS PROGRAM ON A FLOPPY DISK, CHECK TO
SEE THAT YOU HAVE NOT PLACED A 'WRITE PROTECT' TAB ON
THE DISKETTE. YOU WILL NOT BE ABLE TO SAVE ANY CHANGES
MADE IN THE DATA IF A 'WRITE PROTECT' TAB IS PRESENT.

HIT ENTER TO CONTINUE
```

write
protect
tab
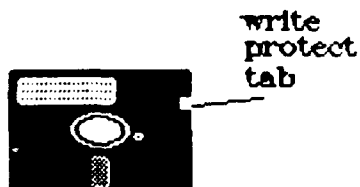
THE FORCE MODEL IS A USER INTERACTIVE, PERSONNEL FLOW
MODEL WHICH FORECASTS THE DISTRIBUTION OF OFFICER
PERSONNEL IN THE GRADES OF ENSIGN THROUGH CAPTAIN AND
YEARS OF SERVICE 1 THROUGH 31.

THE MODEL IS BASED ON 6 MATRICES OF SIZE 31 X 6. THE 31
ROWS STAND FOR YEARS OF SERVICE (YOS) AND THE 6 COLUMNS
FOR THE GRADES.

THE 6 MATRICES ARE:
OFFICER INVENTORIES, ACCESSIONS, LOSSES, SELECTEES,
CONTINUATION RATES, AND PROMOTION RATES.

THE MODEL USES YEARS OF SERVICE AS A PROXY FOR YEAR
GROUP.
EXCEPT FOR THE ACCESSION DATA, THE FORMULA FOR
DETERMINING THE YOS IS: YOS = CURRENT FISCAL YEAR MINUS
YEAR GROUP

FOR ACCESSIONS, YOS IS DETERMINED AS:
YOS = CURRENT FISCAL YEAR MINUS YEAR GROUP + 1

THE 6 MATRICES KNOWN AS DATA COMPONENTS, WHILE SELF
EXPLANATORY, WILL BE DESCRIBED ON THE FOLLOWING SCREEN

HIT ENTER TO CONTINUE

---

1. INVENTORIES - THE NUMBER OF OFFICERS IN EACH YEAR OF
SERVICE AND GRADE AT THE BEGINNING OF THE FISCAL YEAR.
2. ACCESSIONS - THE NUMBER OF NEW ENTRANTS INTO THE
SYSTEM DURING THE FY.
3. LOSSES - THE NUMBER OF OFFICERS EXITING THE SYSTEM
DURING THE FY. LOSSES MAY BE USED TO COMPUTE THE
CONTINUATION RATES.
4. SELECTEES - THE NUMBER OF OFFICERS SELECTED FOR
PROMOTION DURING THE FISCAL YEAR. SELECTEES MAY BE USED
TO COMPUTE THE PROMOTION RATES
5. CONTINUATION RATES - THE PERCENT OF OFFICERS ON
ACTIVE DUTY AT THE BEGINNING OF THE FISCAL YEAR WHO ARE
STILL ON ACTIVE DUTY AT THE END OF THE SAME FISCAL YEAR.
6. PROMOTION RATES - THE PROPORTION OF OFFICERS IN THE
INVENTORY WHO WERE SELECTED FOR PROMOTION.

HIT ENTER TO CONTINUE

```
THERE ARE TWO WAYS TO RETRIEVE DATA:
1.  ALL DATA COMPONENTS RETRIEVED FROM THE SAME DATA
FILE(S);
2.  EACH DATA COMPONENT RETRIEVED FROM SEPARATE FILE(S).

IF MORE THAN ONE FILE(S) IS SELECTED, THE AVERAGE OF
EACH DATA COMPONENT IS COMPUTED.

AFTER ESTABLISHING WHICH OF THE FILE(S) TO USE, THE
FOLLOWING DATA FUNCTION ARE AVAILABLE:
1.  DISPLAY THE DATA
2.  CHANGE THE DATA
3.  COMPUTE THE CONTINUATION RATES
4.  COMPUTE THE PROMOTION RATES
5.  PROJECT INVENTORIES FOR UP TO 10 YEARS
6.  SAVE THE DATA
7.  CONTROL PRINTER

NEWLY CREATED DATA --- THROUGH MERGING DATA COMPONENTS
FROM SEVERAL EXISTING FILES OR BY CHANGING SOME DATA
COMPONENTS -- MAY BE SAVED IN AN EXISTING FILE OR A
NEWLY NAMED FILE.

HIT ENTER TO START RUNNING THE  F O R C E  MODEL.
```

If you choose not to read the instructions, just press [ENTER] and you will receive the first screen used to select the data components.

3. **Starting from a hard drive**.

If your computer has a hard disk drive, it is recommended that the model and data files be placed in their own subdirectory on the hard drive. Boot the computer and change to the C prompt (C>). Type "CD\" and [ENTER]. This command will ensure that you change to the ROOT directory on your hard drive.

Next, type the command "MD \FORCE" and press [ENTER].
You have now created a subdirectory titled FORCE. Now, type
"CD\FORCE" and press [ENTER]. You have just changed
directories to the subdirectory titled FORCE.

Place the original floppy disk in drive A: and type
the following: "COPY A:*.* C:" press [ENTER]. This command
will copy all the files from your floppy drive to the
subdirectory called FORCE.

Each time you turn on the computer, type the command,
"CD\FORCE" [ENTER], prior to starting the model. After you
have changed to the subdirectory, type "MSC" and the model
will load itself as described above in section two.

B. SELECTING DATA

1. Select all components from the same file or file(s).

The user will be presented with the following screen:

```
YOU MAY SELECT ANY NUMBER OF THE FILES LISTED BELOW TO
RETRIEVE    A L L    D A T A    C O M P O N E N T S
FROM THE SAME FILE(S) BY TYPING ONE OR MORE OF THE
CORRESPONDING NUMBERS:  1 2 3 ....

     1.   HCA85
     2.   HCA86
     3.   HCA87
     4.   HCA88
     5.   HCA89
     6.   MSCFY85
     7.   MSCFY86
     (etc.)
```

If you are working with the HCA data and wanted to
forecast with all the components from the HCA89 data file, you

would type the number [5] and press [ENTER]. However, if you are working with the HCA data and you wanted to average all the components for the last two years, you would type the numbers [4] and [5] and press [ENTER]. No brackets or commas between the numbers are required to select two or more files. A blank space must be used to separate between numbers.

2.   **Select individual components from separate file(s).**

The second method of selecting data is to choose each component from a separate file. At the bottom of the screen that listed the files, you will see the message:

```
OR ELSE YOU MAY DECIDE TO RETRIEVE EACH DATA COMPONENT
FROM SEPARATE FILES BY NOW TYPING: 0
```

If you selected zero, you will be prompted for each of the components. You will receive six screens very similar to the first screen. You will type a number(s) associated with the data file(s) you want. For instance, if you want the inventory from the HCA89 file, you type [1]. The next screen will ask you to select the file containing the accessions you desire. As explained above in section B.1., if you type two or more numbers, the files will be averaged. So if you wanted to average the accessions over the last five years, at this prompt you would type [1 2 3 4 5], [ENTER] and the next screen will appear. If you want any one of the six components to be left blank, select [0]. After you have selected all six components, you will be presented with the main menu.

113

C. **DISPLAY THE DATA**

The first option on the main menu allows the user to display the data.

```
                  M O D E L    M E N U

    YOU MAY SELECT FORM THE FOLLOWING MODEL FUNCTIONS:

      0. EXIT THE MODEL WITHOUT SAVING DATA       TYPE 0
   >  1. DISPLAY THE DATA                         TYPE 1
      2. CHANGE THE DATA                          TYPE 2
      3. COMPUTE CONTINUATION RATES               TYPE 3
      4. COMPUTE PROMOTION RATES                  TYPE 4
      5. PROJECT INVENTORIES FOR FUTURE YEARS     TYPE 5
      6. S A V E    D A T A                       TYPE 6
      7. CONTROL PRINTER                          TYPE 7
```

If you select option one, you are presented with the following menu:

```
            D A T A    D I S P L A Y    M E N U

    THE FOLLOWING DATA MAY BE DISPLAYED BY TYPING THE
    APPROPRIATE NUMBER:

      0. DONE DISPLAYING DATA                     TYPE 0
      1. OFFICER INVENTORIES BY YOS AND GRADE     TYPE 1
      2. OFFICER ACCESSIONS BY YOS AND GRADE      TYPE 2
      3. OFFICER LOSSES BY YOS AND GRADE          TYPE 3
      4. OFFICER SELECTEES BY YOS AND GRADE       TYPE 4
      5. CONTINUATION RATES BY YOS AND GRADE      TYPE 5
      6. PROMOTION RATES BY YOS AND GRADE         TYPE 6
```

If you select one of the options, the data will scroll by fairly quickly on the screen. You can scroll back to the top of the data by using either the [PGUP] key or several up arrow keystrokes. Likewise, scroll the screen down with the down arrows or the [PGDN] key. ** You must return the cursor to

114

the original place (the bottom of the last page of text) before pressing the [ENTER] key or proceeding with the model.

D. CHANGE THE DATA

The greatest advantage to this interactive software is the option available to the user to change any element of the data and continue to forecast inventories. The user has the liberty to test the "*what if*" questions related to various policy proposals. Promotion rates, continuation rates, number of losses, selectees and accessions could all be adjusted by the user to measure the effects on future inventories.

The change data option is the second option on the main menu. Select number [2] and you will be presented with the following screen:

```
            C H A N G E    D A T A    M E N U

THE FOLLOWING DATA MAY BE CHANGED BY TYPING THE
APPROPRIATE NUMBER:

     0. DONE WITH CHANGING DATA               TYPE 0
     1. OFFICER INVENTORIES BY YOS AND GRADE  TYPE 1
   > 2. OFFICER ACCESSIONS BY YOS AND GRADE   TYPE 2
     3. OFFICER LOSSES BY YOS AND GRADE       TYPE 3
     4. OFFICER SELECTEES BY YOS AND GRADE    TYPE 4
     5. CONTINUATION RATES BY YOS AND GRADE   TYPE 5
     6. PROMOTION RATES BY YOS AND GRADE      TYPE 6
```

For example, if you wanted to change the number of accessions, you would select number [2]. The next prompt would read:

115

```
SELECT GRADE FOR WHICH OFFICER ACCESSIONS ARE TO BE
CHANGED:

TYPE ONE OF THE NUMBERS: 1 2 3 4 5 6 AND ENTER;
OR TYPE: 0      IF DONE WITH ALL CHANGES
```

If you want to adjust the lieutenant accessions, type the number [3] and you will be presented with the next prompt.

```
SELECT YOS FOR WHICH OFFICER ACCESSIONS ARE TO BE
CHANGED:

TYPE ANY NUMBER OF THE YOS: 1 THROUGH 31 AND ENTER
OR TYPE: 0      IF DONE WITH ALL CHANGES
```

You may adjust several of the YOS categories at one time. In this case, if you want to adjust the lieutenant accessions with 1, 2, and 3 years of service, at this prompt, type "1 2 3" and hit [ENTER].

You will be told what the current officer accession numbers are as recorded in the active file you are attempting to change. The prompt will ask you to type in the new accessions. Type three numbers, without commas, one space apart. If you listed three YOS categories in the previous prompt, you MUST type in three numbers. The program will report an error and ask you to try again if you do not type in the same number of accessions numbers as the YOS categories selected at the previous prompt. If you decide not to change one or all of these numbers, you must retype the current numbers that were displayed.

116

```
SELECT YOS FOR WHICH OFFICER ACCESSIONS ARE TO BE
CHANGED:

TYPE ANY NUMBER OF THE YOS: 1 THROUGH 31 AND ENTER
OR TYPE: 0       IF DONE WITH ALL CHANGES

   1 2 3        [ENTER]

CURRENT OFFICER ACCESSIONS ARE:   0 35 24

TYPE NEW OFFICER ACCESSIONS!

   0 37 26        [ENTER]
```

After you have completed the change, you will be asked
whether you want to look at the new officer accessions. If
you select one, the accession matrix will scroll up the
screen. If you select zero, you will be returned to the
prompt to select another grade to be changed. If you are
finished with your accession changes, type zero [0], and you
will be returned to the change menu. At this point, you may
choose to change another component or type [0] and return to
the main menu.

E.   COMPUTE RATES

The third and fourth options on the main menu are to
compute the continuation and promotion rates. The program is
designed so that the user may input losses and selectees, and
then compute the rates by selecting one or both of these
options. The program will divide the losses (or selectees) by
the inventory of officers with the same years of service to
create the continuation rates and/or the promotion rates.

After selecting either one of these two options, the user will be asked if the rates should be displayed and also warns that these rates may be saved by selecting the 'SAVE DATA' option from the main menu.

F. PROJECT INVENTORIES FOR FUTURE YEARS

Option five from the main menu allows the user to forecast future inventories.

```
                    M O D E L   M E N U

YOU MAY SELECT FORM THE FOLLOWING MODEL FUNCTIONS:

    0. EXIT THE MODEL WITHOUT SAVING DATA      TYPE 0
    1. DISPLAY THE DATA                        TYPE 1
    2. CHANGE THE DATA                         TYPE 2
    3. COMPUTE CONTINUATION RATES              TYPE 3
    4. COMPUTE PROMOTION RATES                 TYPE 4
 >  5. PROJECT INVENTORIES FOR FUTURE YEARS    TYPE 5
    6. S A V E    D A T A                      TYPE 6
    7. CONTROL PRINTER                         TYPE 7
```

After selecting number [5] and pressing [ENTER] you will see the following prompt:

```
DO YOU WANT TO HAVE THE PROMOTION RATES MULTIPLIED BY
CONTINUATION RATES?

IF YES TYPE 'Y' AND HIT ENTER, OTHERWISE JUST HIT ENTER
```

The discussion regarding this option is available in Chapter 3, Section A.3 of this thesis. If you choose 'Y', the promotion rates are multiplied by the continuation rates. This will reduce the promotion rate and reduce the projection of officers to the next paygrade. Under most circumstances,

DO NOT select the 'Y' option. At this prompt, just press
[ENTER].

The next question asked is:

```
┌─────────────────────────────────────────────────────────────┐
│                                                             │
│  HOW MANY YEARS DO YOU WANT TO FORECAST INVENTORIES         │
│  STARTING WITH CURRENT INVENTORIES AND CURRENT              │
│  ACCESSIONS?                                                │
│                                                             │
│  IF YOU DECIDED NOT TO FORECAST  TYPE 0                     │
│                                                             │
└─────────────────────────────────────────────────────────────┘
```

If you wanted to forecast three years, you would type [3]
and press [ENTER]. The next display would look like this:

```
┌─────────────────────────────────────────────────────────────┐
│           R E S U L T S   D I S P L A Y   M E N U           │
│                                                             │
│  THE FOLLOWING RESULTS MAY BE DISPLAYED BY TYPING THE       │
│  APPROPRIATE NUMBER:                                        │
│                                                             │
│  0. DONE WITH DISPLAYING RESULTS              TYPE 0        │
│  1. INVENTORIES BY YOS AND GRADE FOR YEAR 1   TYPE 1        │
│  2. INVENTORIES BY YOS AND GRADE FOR YEAR 2   TYPE 2        │
│  3. INVENTORIES BY YOS AND GRADE FOR YEAR 3   TYPE 3        │
│                                                             │
└─────────────────────────────────────────────────────────────┘
```

You may view any one of the forecasted inventories by
selecting the appropriate number associated with the number of
years forward from the year which the beginning inventories
represented. For example, if you used 1989 data file, then
number [3], "inventory for year 3," would display the
projected inventory for 1992.

When you are finished displaying the future inventories,
select [0], "Done with displaying results." The next prompt
will ask if you want to replace the current inventories with

119

any one of these projected inventories. Select the [0] to

leave the current inventory data unchanged.

```
┌────────────────────────────────────────────────────────────────┐
│                   INVENTORY REPLACEMENT MENU                   │
│                                                                │
│  YOU MAY SELECT ONE OF THE COMPUTED INVENTORIES TO             │
│  REPLACE THE CURRENT INVENTORIES BY TYPING ONE OF THE          │
│  NUMBERS:                                                       │
│                                                                │
│     0. LEAVE CURRENT INVENTORIES AS THEY ARE      TYPE 0       │
│     1. REPLACE INVENTORIES WITH THOSE OF YEAR 1   TYPE 1       │
│     2. REPLACE INVENTORIES WITH THOSE OF YEAR 2   TYPE 2       │
│     3. REPLACE INVENTORIES WITH THOSE OF YEAR 3   TYPE 3       │
│                                                                │
└────────────────────────────────────────────────────────────────┘
```

G.   SAVING YOUR CHANGES AND FORECASTS

The sixth option on the main menu is to   S A V E   your

changes or inventory forecasts. The next screen is:

```
┌────────────────────────────────────────────────────────────────┐
│  IF YOU HAVE NOT MADE ANY CHANGES IN THE ORIGINAL DATA OR      │
│  WANT TO LOSE ANY CHANGES YOU MAY HAVE MADE, THERE IS          │
│  NOTHING YOU MUST DO BEFORE EXITING THE MODEL                  │
│                                                                │
│  HOWEVER, IF YOU MADE CHANGES IN THE ORIGINAL DATA AND         │
│  WANT TO SAVE IT FOR LATER USE YOU HAVE TWO OPTIONS:           │
│                                                                │
│  1.   YOU MAY EITHER SAVE IT IN PLACE OF THE ORIGINAL DATA     │
│       UNDER THE SAME NAME IN WHICH CASE THE ORIGINAL DATA      │
│       WILL BE LOST; OR                                         │
│                                                                │
│  2.   YOU MAY SAVE THE ENTIRE DATA SET UNDER A NEW NAME        │
│  WITH YOUR CHANGES IN IT; IN THIS CASE THE ORIGINAL DATA       │
│  REMAINS INTACT UNDER THE OLD NAME.                            │
│                                                                │
│  TYPE 'Y' AND HIT ENTER IF YOU WANT TO SAVE DATA OR JUST       │
│  HIT ENTER                                                      │
│                                                                │
└────────────────────────────────────────────────────────────────┘
```

If you selected option six, to save data, and you change

your mind, just press [ENTER] at this first prompt and you

will return to the main menu.

Once you typed 'Y' at this first prompt, you will be presented with another choice.

READ THIS OPTION CAREFULLY. YOUR ORIGINAL DATA MAY BE LOST IF YOU DO NOT EXECUTE THIS OPTION CORRECTLY.

You will be presented with the following:

YOU MUST NOW CHOOSE BETWEEN THE FOLLOWING TWO OPTIONS:

1. SAVE THE CURRENT DATA UNDER THE ORIGINAL NAME OF ' '
    IN WHICH CASE THE ORIGINAL DATA WILL BE LOST; OR

2. SELECT A NEW NAME AND SAVE THE DATA UNDER THAT NAME.

This program has an added safety feature programmed into this SAVE module to prevent accidental loss of data files. You may back out of the 'save data' by pressing [ENTER] again or you must CONFIRM your desire to replace the original data with the current data by typing a 'Y' at this prompt:

TYPE 'Y' AND HIT ENTER IF YOU ARE SURE YOU WANT TO REPLACE THE ORIGINAL DATA WITH THE CURRENT DATA. OTHERWISE JUST HIT ENTER

JUST HIT ENTER IF YOU DECIDED NOT TO SAVE AT ALL. OTHERWISE:
SELECT A NEW NAME OF AT MOST EIGHT CHARACTERS FOR THE NEW FILE. THE FIRST CHARACTER MUST BE A LETTER, THE REST MAY BE LETTERS OR NUMBERS; NO BLANK SPACE PERMITTED, EXCEPT AT THE END.

If you gave the data file a new name, you will receive a prompt stating that the data has been saved under the new name, and you will be returned to the main menu.

H. PRINTER OPERATIONS

The printer option is a toggle to turn the printer 'on' or 'off'. When the printer is toggled 'on', everything that is displayed on the screen is automatically transferred to the printer as well. Under normal operations, you will probably prefer to leave the printer turned 'off'. This is the default position when you start the software.

If your keyboard contains a "PRINT SCREEN" key, you may prefer to use this method to print. The screen can be scrolled up or down by use of the arrow keys or the PGUP and PGDN keys on most standard keyboards.

I. QUIT

To leave the "Force" model, select the zero [0] from the main menu. This will return you to the APL workspace. Hold the SHIFT key and press the double quote key ["]. You will see the right parentheses appear on the screen. (This is because of the APL keyboard character set mentioned at the beginning of this manual). Type the word "OFF" next to the right parentheses:)OFF and press [ENTER]. This will return you to the DOS operating system and also return your keyboard functions to normal.

122

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